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CANADIAN MACHINERY AND MANUFACTURING NEWS

A weekly newspaper covering in a practical manner the mechanical power, foundry and allied fields.
Published by the MacLean Publishing Company, Limited, Toronto, Canada

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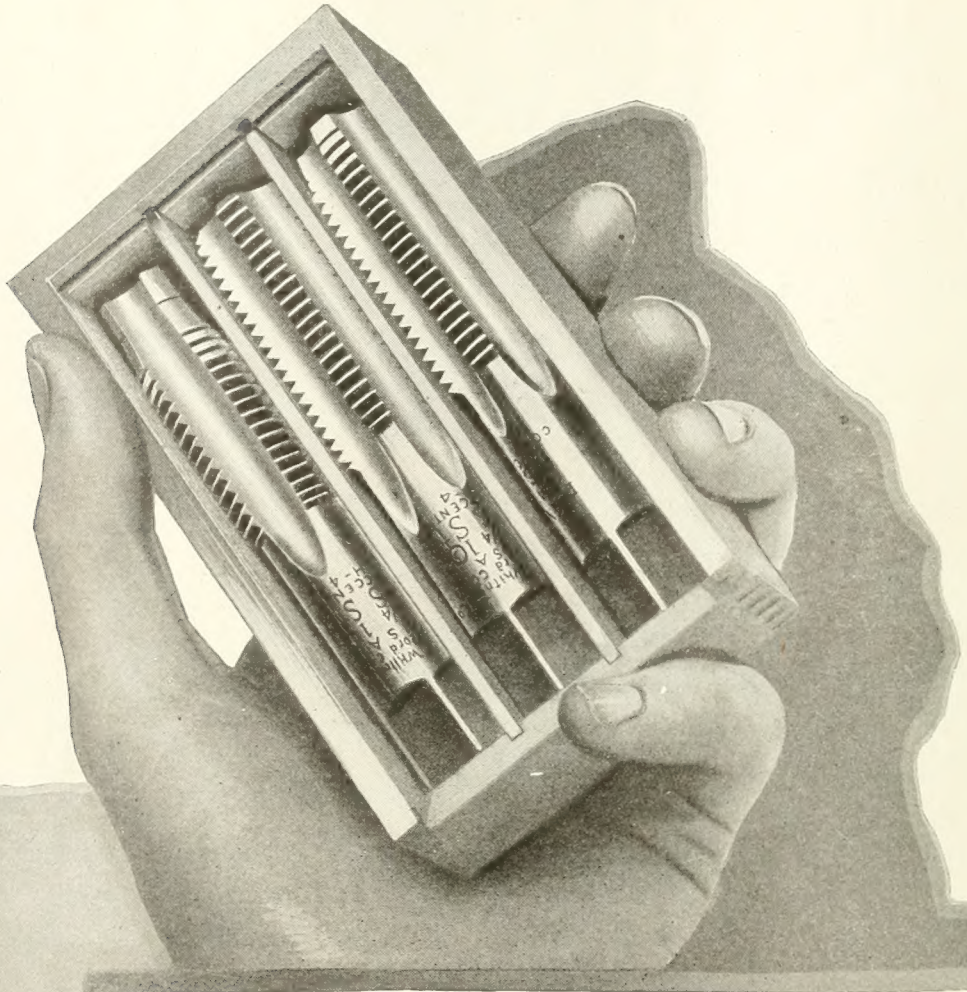

P & W

Pratt & Whitney Taps

"With the 'Con-eccentric' Land"

P & W Taps are **good** taps —easily the best where accuracy and high speed are essential. They cost more to buy, but less to use than others.

If you're doing work that calls for big production and for unusual precision give them a trial. You'll be back for more when you see them prove themselves.

The "con-eccentric" land — the special feature of Pratt & Whitney Taps permits sharpening on face of the cutting edge without affecting size. It lengthens life and assures accuracy hitherto thought impossible in a commercial tool.

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New York, 326 Hudson St. **Boston,** 93-95 Oliver St. **Philadelphia,** 405 N. 21st St. **Cleveland,** 730 Superior Ave. **Detroit,** Kerr Machy. Bldg. **Chicago,** 571 W. Washington Blvd. **St. Louis,** 516 N. 3rd St. **Cincinnati,** 336 W. Fourth St. **Birmingham, Ala.,** 2015 First Ave. **St. Paul, Minn.,** Robinson, Cary & Sands Co. **New Orleans,** C. T. Patterson Co., Ltd. **San Francisco,** 16 to 18 Fremont St. **In Canada—** Pratt & Whitney Co. of Canada, Ltd., **Dundas, Montreal, Toronto, Winnipeg, Vancouver.**

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Works : DUNDAS, Ontario

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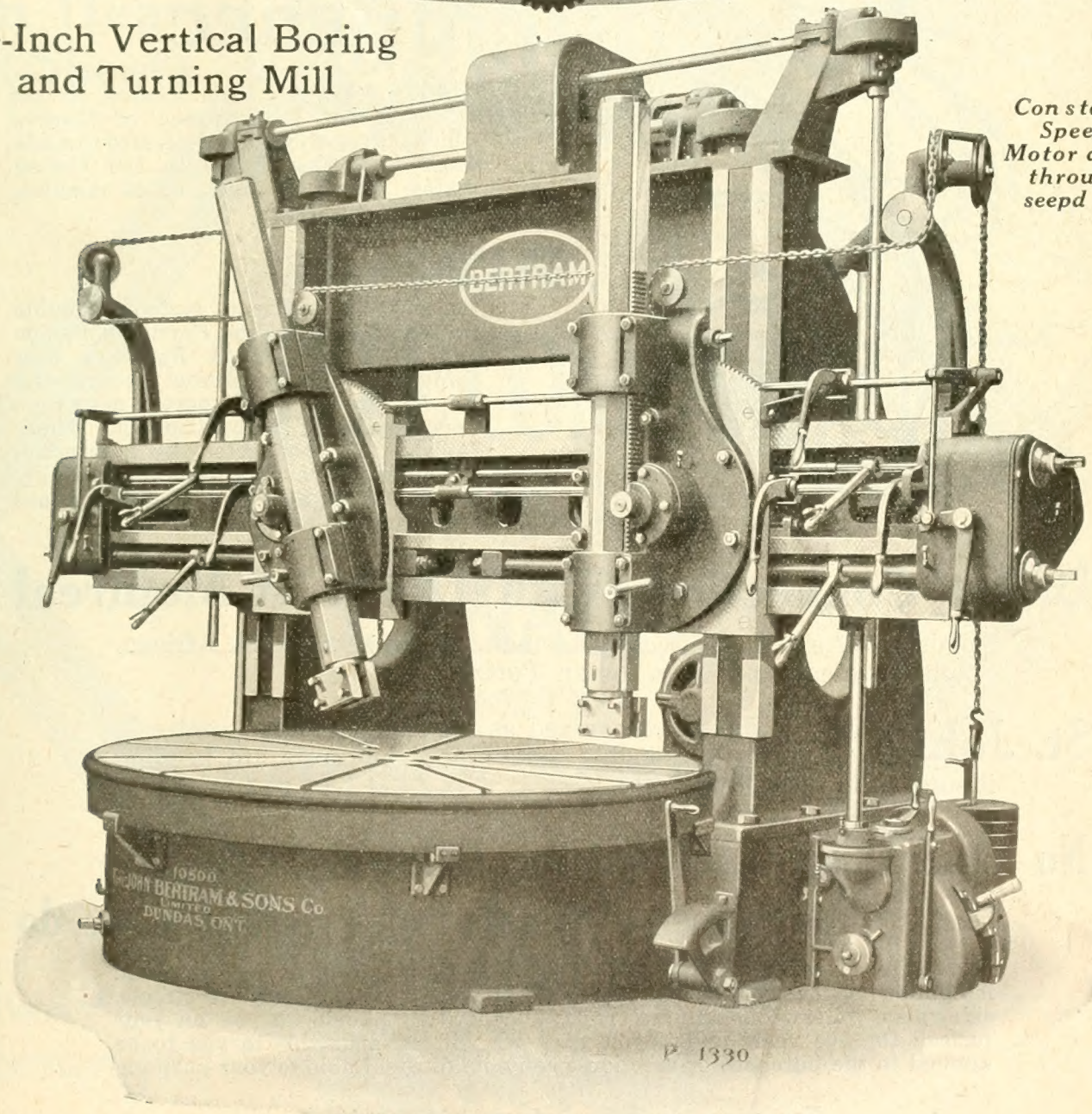
The BERTRAM Page

MACHINE TOOLS

J.B.&S.Co.

84-Inch Vertical Boring and Turning Mill

Constant Speed Motor drive through seepd box



P 1330

The John Bertram & Sons Co., Limited

DUNDAS. ONTARIO. CANADA.

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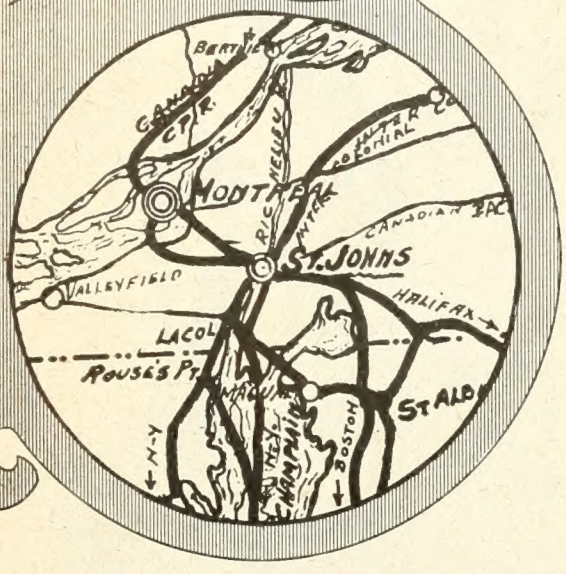
Canadian Machinery and Manufacturing News, December 11th, 1919. Vol. 22, No. 24. Published weekly at 143-153 University Ave., Toronto, Canada. Subscription price in Canada, $3; United States, $3.50. Entered as second-class matter at the Post Office Department, Ottawa, Canada. Entered as second-class matter July 1, 1912, at the Post Office at Buffalo, under the Act of March 3rd, 1879.

The City of ST. JOHNS, QUEBEC



ITS LOCATION

It is located in the Province of Quebec which, as regards industries, is to Canada what New England is to the United States. (It is 27 miles, or 45 minutes, from Montreal).

ITS RAILWAYS

The two big railroad systems (double track) of Canada, the Canadian Pacific and the Grand Trunk Railways, pass through St. Johns, where merchandise can be shipped and exported anywhere upon the globe with dispatch. These railways are connected by a terminal switching system: charges at exceedingly low rate. All Eastern U.S. railroads are connected with St. Johns.

Direct Connections with Docks at Montreal

Goods can be exported direct by steamers to European, South African, South American and West Indian Ports.

St. Johns has long been recognized as the cheapest labor centre in Canada. Reasonable rents and living costs are keeping it so even in these times.

No other locality offers the following inducements to new industries---but we do

Exemption of taxes for fifteen years' period that is subject to extension. All public improvements which you may require, such as extension of streets, sidewalks, waterworks and sewerage; five per cent. bonus to you on your payroll for five years and if you wish we will advance this to you to be applied to the purchase or erection of any building suitable to your purpose.

For more specific information write to

The Secretary of the City Council

St. Johns, Quebec, Canada

By Product Coke

Hamilton Pig Iron

Open Hearth
Steel Billets

Steel and
Iron Bars

Open Hearth
Steel Sheets

Drop
Forgings

Quality

THE
STEEL COMPANY
OF
CANADA
LIMITED
HAMILTON MONTREAL

Service

Railway
Fastenings

Wrought
Pipe

Pole Line
Hardware

Screws & Nails

Bolts Nuts & Washers

Wire & Wire Products

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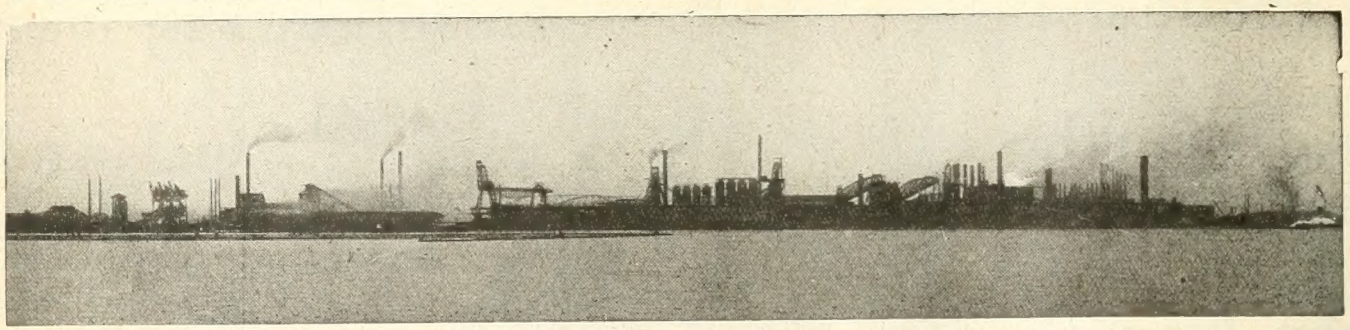

General View of the Plant of the Algoma Steel Corporation from the Waterfront.

ANNOUNCEMENT

MARK OF ALGOMA O.H. QUALITY

THE ALGOMA STEEL CORPORATION, LIMITED, take pleasure in announcing to their customers and the Canadian trade that in accordance with the widespread desire throughout the Dominion that there should be obtained in Canada with Canadian labor, a much larger proportion of the requirements of this country in STEEL SECTIONS for STRUCTURAL PURPOSES, CAR CONSTRUCTION, SHIPBUILDERS' REQUIREMENTS, etc., they are just completing extensive alterations and additions to their rolling mills, and on or about 1ST NOVEMBER, will be ready to produce and ship American Standard Sections of BEAMS and CHANNELS up to and including 15", all standard sections of ANGLES from 6" x 6" down to 1¼" x 1¼", ZEE BARS for car builders and general purposes, small and large ROUNDS and SQUARES, and FLAT BARS up to 14" wide. The quality of the product is already well known to the trade, and is exclusively steel made by the Open Hearth process, and can be furnished in all grades from the softest rivet stock to high carbon special spring material.

The following are the sections which will be rolled:---

ANGLES—Equal Leg—
6 x 6"—5 x 5"—4 x 4"
3½ x 3½"—3 x 3"
2½ x 2½"—2¼ x 2¼"
2 x 2"—1¾ x 1¾"
1½ x 1½"—1¼ x 1¼"

ANGLES—Unequal Leg—
6 x 4"—6 x 3½"—5 x 4"
5 x 3½"—5 x 3"—4½ x 3"
4 x 3½"—4 x 3"—3½ x 3"
3½ x 2½"—3 x 2½"—3 x 2"
2½ x 2"

BEAMS—
15", 12", 10", 8", 6", 5", 4", 3".

CHANNELS—
15", 13", 12", 10", 8", 6", 5", 4", 3".

ZEES—
3¼ x 5 x 3¼ x 5/16
3 5/16 x 5 1/16 x 3 5/16 x ⅜"
3⅜ x 5⅛ x 3⅜ x 7/16"
3 1/16 x 4 x 3 1/16 x ¼"
3⅛ x 4 1/16 x 3⅛ x 5/16"
3 3/16 x 4⅛ x 3 3/16 x ⅜"
2 11/16 x 3 x 2 11/16 x ¼"
2¾ x 3 1/16 x 2¾ x 5/16"

ROUNDS—
All sizes from ½" up to and including 4".

SQUARES—
All sizes from ½" up to and including 3".

FLATS—
All sizes from 1 x ¼" up to and including 14" wide.

MINE RAILS—
All sections from 12 lbs. up to and including 45 lbs. per yard.

PIG IRON—
Machine cast FOUNDRY MALLEABLE and BASIC.

SULPHATE OF AMMONIA.
NITRE CAKE.

For the better convenience of customers who may find it necessary to secure rush shipments of particular items, they contemplate keeping a large stock of all the various standard sections constantly on hand, and to this end extensive warehouse facilities are being prepared.
Your enquiries and business will be appreciated.

ALGOMA STEEL CORPORATION

SAULT STE. MARIE, ONTARIO

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HIGH SPEED AND CARBON TWIST DRILLS

REAMERS AND MILLING CUTTERS

Quality First

The Keystone Upon Which All WILT Products Are Built

A high standard of perfection is maintained throughout the various processes of manufacturing **WILT High Speed and Carbon Twist Drills, Reamers and Milling Cutters.** **WILT** products improve production! This is no theory, no untested statement, but an established fact backed by many of the largest manufacturers throughout Canada. For steady, reliable output of work that is satisfactory from the standpoint both of quantity and quality there is no better choice than **WILT Products.**

Put Them to the Test

WILT TWIST DRILL COMPANY

OF CANADA, LTD. WALKERVILLE, ONT.

London Office: Wilt Twist Drill Agency, Moorgate Hall, Finsbury Pavement, London, E.C. 2, England.

"Where there's a WILT — there's the Way"

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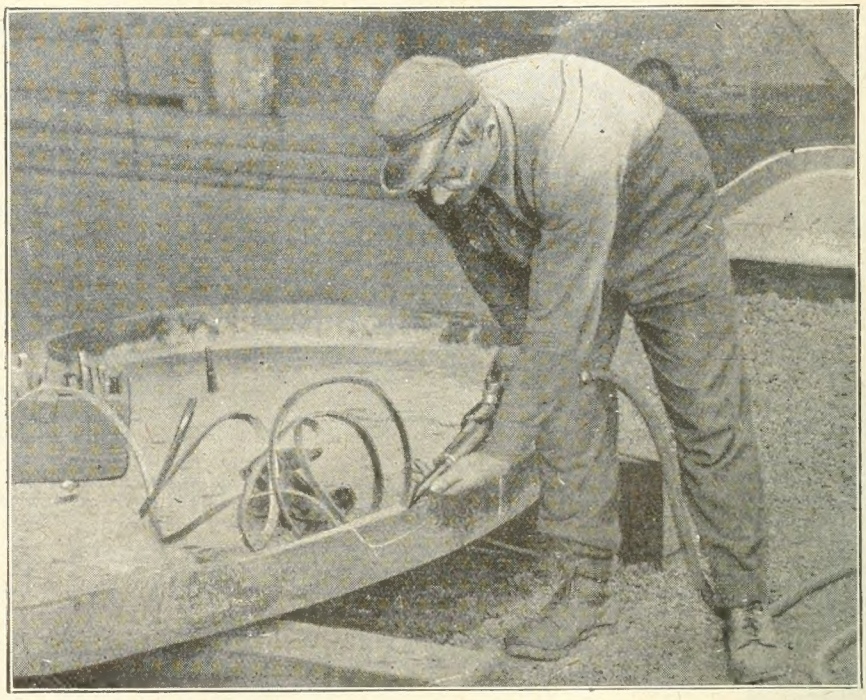
Chips Like This Are Not Unusual When Your Men Are Armed With "Little Davids"

Because "Little David" Chippers are made to stand up and produce on all sorts of hard jobs. Nobody appreciates quality in tools more than a good workman and this is why using "Little Davids" is a matter of pride with many of the most skilful mechanics in the country.

"Little David" Tools are "Made In Canada" and "Little David" Service extends from coast to coast. Are the "Little David" bulletins in your files.



Canadian Ingersoll-Rand Company Limited

SYDNEY COBALT SHERBROOKE WINNIPEG MONTREAL NELSON TORONTO VANCOUVER

Swedish Steel & Importing Co., Limited

Montreal New York Toronto Denver

Direct representatives of foremost Swedish mills: makers of

Tool Steels

ALLOY STEELS, BILLETS, BARS, DISCS, SHEETS, HIGH SPEED STEELS, DRILL RODS, DRAWN BARS, SEAMLESS TUBING, COLD ROLLED STRIP STEEL, WELDING WIRE, WROUGHT AND ROLLED IRON, PIG IRON, STEEL AND IRON ENDS, HOLLOW AND SOLID MINING DRILL STEEL.

TRADE MARK SS "DOUBLE ESS"

PROMPT SHIPMENTS from large stock

Electrite

Electric furnaces, automatically regulated, the most modern methods, and the introduction of Uranium — make this a steel of truly remarkable cutting properties.

We know "Electrite" cannot be bettered — and stand ready to prove it to you.

LATROBE ELECTRIC STEEL CO.

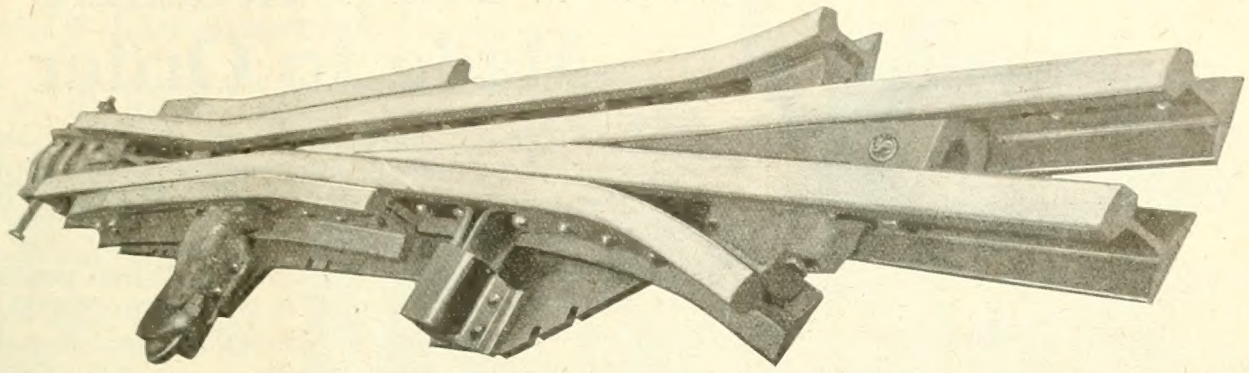
LATROBE, PA.

High Speed Steel

Uranium

TRACKWORK

For Steam and Electric Railways



Built-Up Intersections
Frogs Switches
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Mates Diamonds
Manganese-Steel Intersections
Crosses Switchstands

CANADIAN STEEL FOUNDRIES LIMITED

Transportation Building, Montreal

E&M

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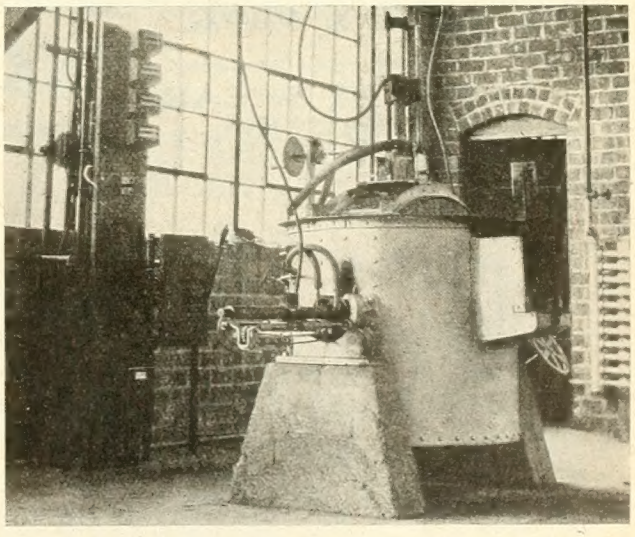
Steel Castings

High Grade STEEL Castings
Of Every Description

Prompt Deliveries

Send us your drawings for estimates.

THE ELECTRIC STEEL AND METALS COMPANY, LIMITED
WELLAND ONTARIO



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Built in capacities from 100 lbs. to 6 gross tons

Melting and Refining Steel, Cast Iron Ferro-Manganese, Copper, Nickel, Aluminum and various Non-ferrous Alloys.

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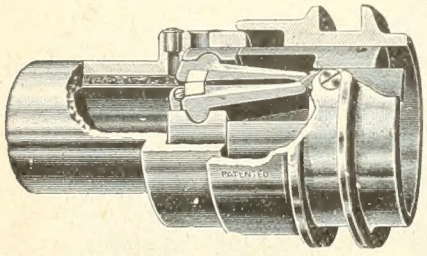
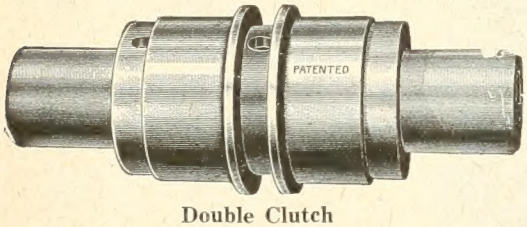
THE JOHNSON FRICTION CLUTCH

The Clutch for Your Machine Made to Order



Single Clutch—Interior—Clutch Disengaged



Double Clutch

Where space is limited and conditions are exacting, the clutch problem presents difficulties —unless you know about Johnson clutches. We offer you an efficient clutch made in any size or form that your machine requires. When you are designing a new machine, it will be worth while to consult us. Our facilities are at your disposal without any obligation to you.

THE JOHNSON FRICTION CLUTCH

THE CLUTCH OF A THOUSAND USES

WRITE TO-DAY FOR OUR YELLOW DATA SHEETS

Canadian Agents:

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CANADIAN FAIRBANKS-MORSE CO., LIMITED, Montreal, Toronto and Winnipeg

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

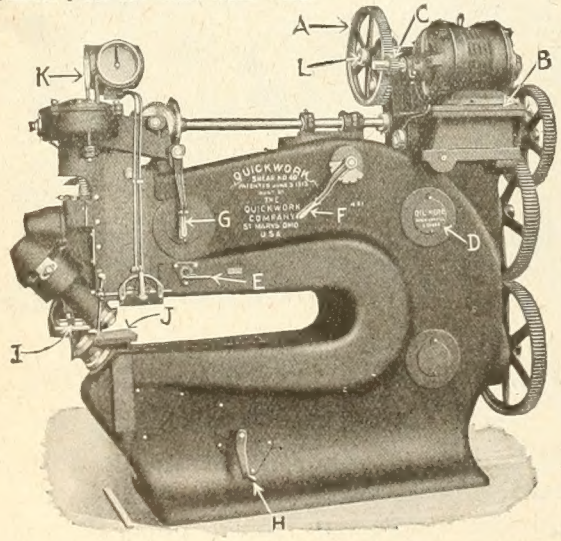
"QUICKWORK"

Registered in U.S. and Foreign Countries.

ROTARY SHEARS

MADE IN 7 SIZES.

Cut all gauges of sheet and plate metal up to 1 inch thick in straight or irregular shapes and openings without cutting in from side of sheet. Leaves square, true edge that requires no finishing. Used in building ships, boilers, tanks, cars and general plate and sheet metal work.



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SAVES 50% TO 90%

Eliminates Oxyacetylene Cutting and Plate Planing.

Write for Catalogue No. 60.

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HIGH SPEED STEEL

INTRA STEEL GIBRALTAR STEEL

Tool Steel for Every Purpose

Swedish Lancashire Iron

Twist Drills, Taps, Hack Saw Blades, Milling Cutters, Files, Etc., Music Wire for Springs, Steel Balls. Cold Rolled Tool Steel in Strips and Sheets Circular Saws, Machine Knives.

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Sole Agents for

JONAS & COLVER, LIMITED
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STEEL *for*

Every Commercial Purpose

We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open-Hearth Steel on the Shortest Notice.

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Steel Ingots
by the
HARMET
Liquid Process

Coal
Coke
Iron Ore

Pig Iron

Victoria FOUNDRY & MALLEABLE

Made by The Canadian Furnace Co.
Port Colborne, Ontario, Canada

M.A. HANNA & Co.

Sales Agents:
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FIRTH'S Speedicut HIGH SPEED Steel

Insures Maximum Production

FIRTH'S CARBON TOOL STEELS
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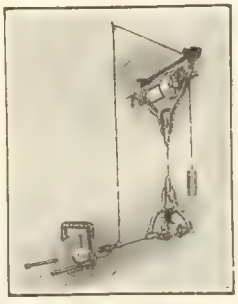
JOHN J. COLEMAN
Canadian Manager

FORD-SMITH Grinders



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FOR EVERY CLASS OF WORK

The "Quality" Line

Modern, rigid, well-balanced machines that give real grinding service.

Built by

The Ford-Smith Machine Co., Limited

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Foreign Agents: W. E. Storey, 3 Arundel St., London, Eng.
Gollin & Co., Melbourne, Australia.

THE SELECTION OF GOOD

BABBITT

is of FIRST IMPORTANCE. Insist on either

"NICKEL GENUINE" or "FROST KING"

Manufactured by

HOYT METAL COMPANY

MONTREAL TORONTO WINNIPEG

SIMONDS

HACK SAW BLADES

UNEQUALED IN QUALITY ANY SIZE OR LENGTH

Simonds Canada Saw Co. Limited

ST. JOHN MONTREAL VANCOUVER

MULTI-DRILLERS NATCO MULTI-TAPPERS

Drilling and Countersinking Nickel Steel Segments

"Most accurate and reliable—surely gets the work out." That's the verdict of the R. D. Nuttall Co., Pittsburgh, who has just become acquainted with NATCO possibilities.

The NATCO drills 12 holes 25-32 inch in diameter to a depth of 2¼ inches. Four of these holes are then countersunk. The piece is a Segment for gun carriage made of nickel steel, and the NATCO does the work at the rate of 18 pieces per day.

Reaming, recessing, tapping, spot-facing, are all within the NATCO range—and the NATCO multi-method has been one of the most prolific production factors where many holes of different dimensions are drilled, tapped, etc., into the same piece. The NATCO patented feature provides approximately the correct speed for each spindle.

We also design and build jigs and fixtures for use in connection with NATCO Multi-Drillers.

The National Automatic Tool Co.
Richmond, Ind., U. S. A.

List of NATCO Foreign Agents

Burton, Griffiths & Co., British Isles; E. Isbesque & Co., Belgium; Allied Machinery Co. of America, Italy, Spain, Portugal and Switzerland; Aux Forges de Vulcain, France

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"WACO"

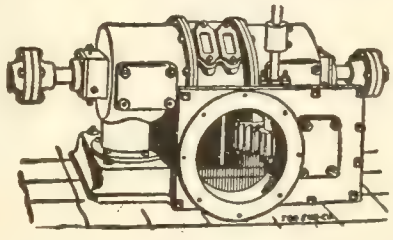
THE HIGH SPEED STEEL

MARSHALL, SON & BUNNEY
39 Richmond Street East TORONTO, ONT.

SOLE CANADIAN AGENTS FOR
WM. ATKINS & CO., LIMITED
SHEFFIELD - ENGLAND

ALL SIZES
IN STOCK

WATER POWER DEVELOPMENT



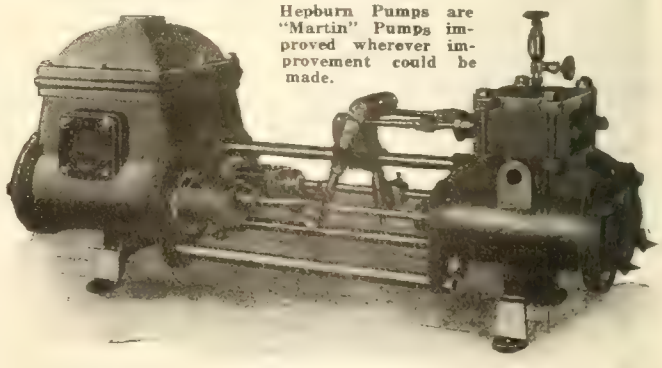
Over forty years' experience in designing and installing special turbines, both on vertical and horizontal shafts.
Can supply complete equipment, including flume, turbine and power transmission.
Stock of standard vertical shaft Little Giant Turbines on hand for prompt shipment.

We solicit your inquiries.

THE J. C. WILSON MFG. CO.
LIMITED
BELLEVILLE, ONTARIO

Hepburn Pumping Machinery

Our line embraces standard duplex pumps for boiler feeding and for fire and general service; tank or low service duplex pumps; duplex hydraulic pumps for service in connection with hydraulic lifts and presses, accumulators and oil presses; pressure or mine pumps; horizontal power pumps and air and circulating pumps, etc.



Hepburn Pumps are "Martin" Pumps improved wherever improvement could be made.

JOHN T. HEPBURN, LIMITED
18-60 Van Horne Street Toronto, Ontario

CANADA
FOUNDRIES & FORGINGS
LIMITED

ENDURANCE TOOLS
NEVER WEAR OUT

PIPE THE WRENCH—WRENCH THE PIPE

Canadian Billings & Spencer Plant
Welland, Ont.

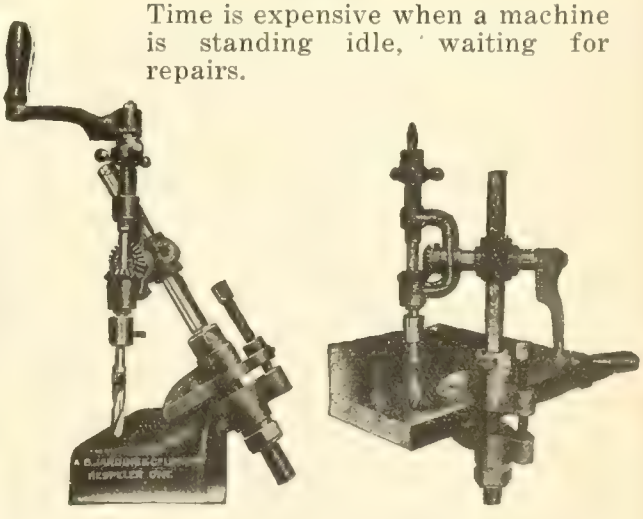
Crucible
AND
Open Hearth Steel
Tool Steel
"ARGO" BRAND *HIGH-SPEED* STEEL

The John Illingworth Steel Co.
1856
Frankford, Phila.
New York Office 217 Broadway

RALPH B. NORTON, AGENT
Montreal, Canada

Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses

A. B. JARDINE & Co., Limited
HESPELER, ONTARIO

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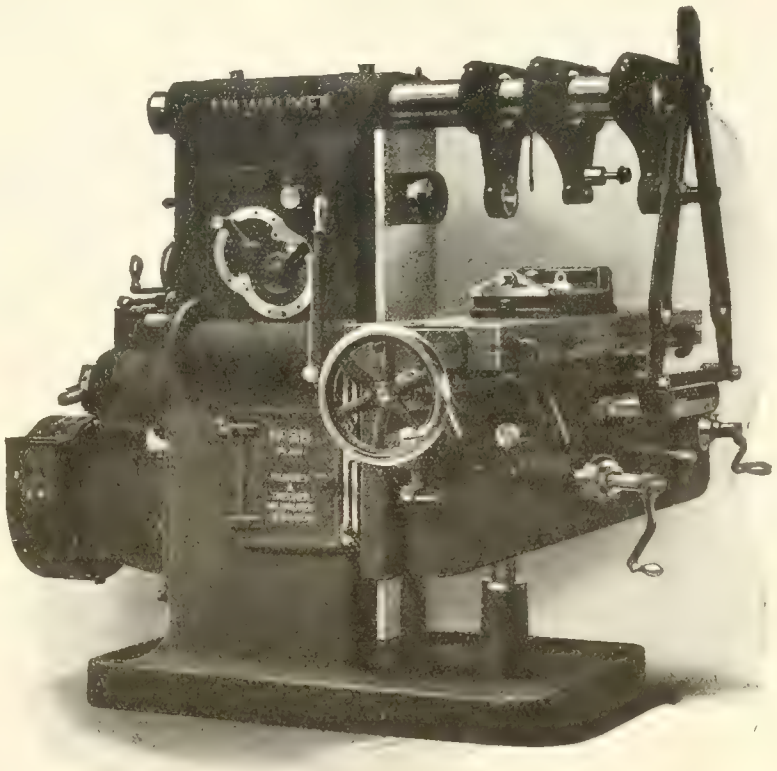


MILWAUKEE MILLING MACHINES

Double Overarm maintains alignment.

It is impossible for the operator to place the arbor supports on the arbor and double overarm in any other way than in line. Arbor cannot be pounded out of line when using large, coarse pitch cutters on rough, heavy work.

Other Distinctive Milwaukee Features:

Solid top knee—hardened steel gearing and shafts in the column and feed box—automatic flooded lubrication — one and one-half gallons of oil per minute pouring over all gears and bearings in the column and feed box, insuring lubrication at all times—flanged spindle with hardened steel collar for driving arbors—constant speed drive, reverse being self-contained.

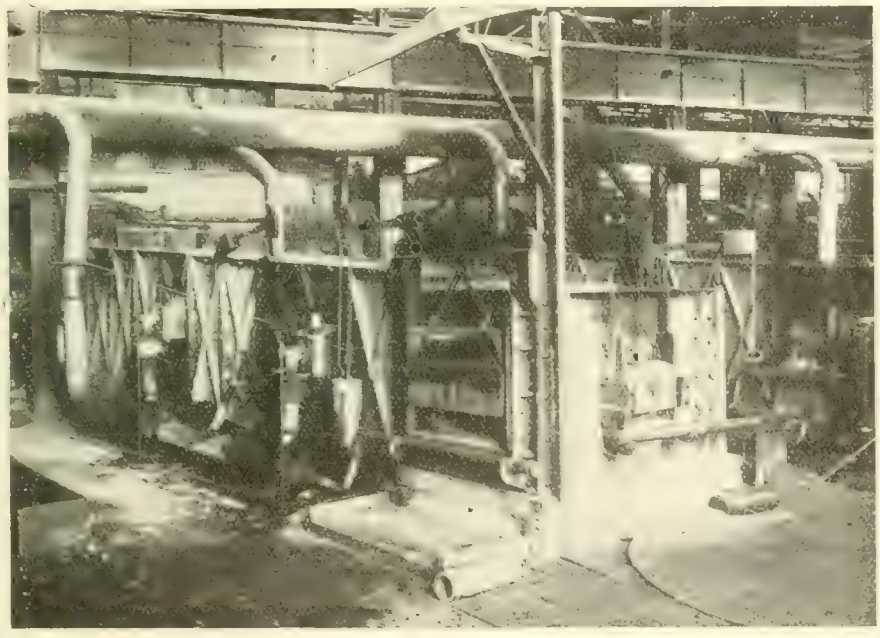
Send for our No. 21 Catalogue. Illustrating and describing Milwaukee Milling Machines and accessories in detail

KEARNEY & TRECKER CO.

MILWAUKEE, WIS. U.S.A.

Another MECOL Furnace

demonstrated its superior features point by point to a group of men whose years of experience in the heat-treatment of metals made them appreciative judges.



We refer to the "Mecol" Furnace shown in this illustration, installed at the Pointe St. Charles Works of the Canadian Steel Foundries, Limited.

Our intimate knowledge of heat-treating methods, and our long experience in the building of efficient furnaces fit us to give helpful advice—and that we will do promptly if you

Write

Mechanical Engineering
Company, Limited
Room 308, Bank of Toronto Bldg., Montreal
Three Rivers, Quebec, Canada

Whitcomb-Blaisdell Planers

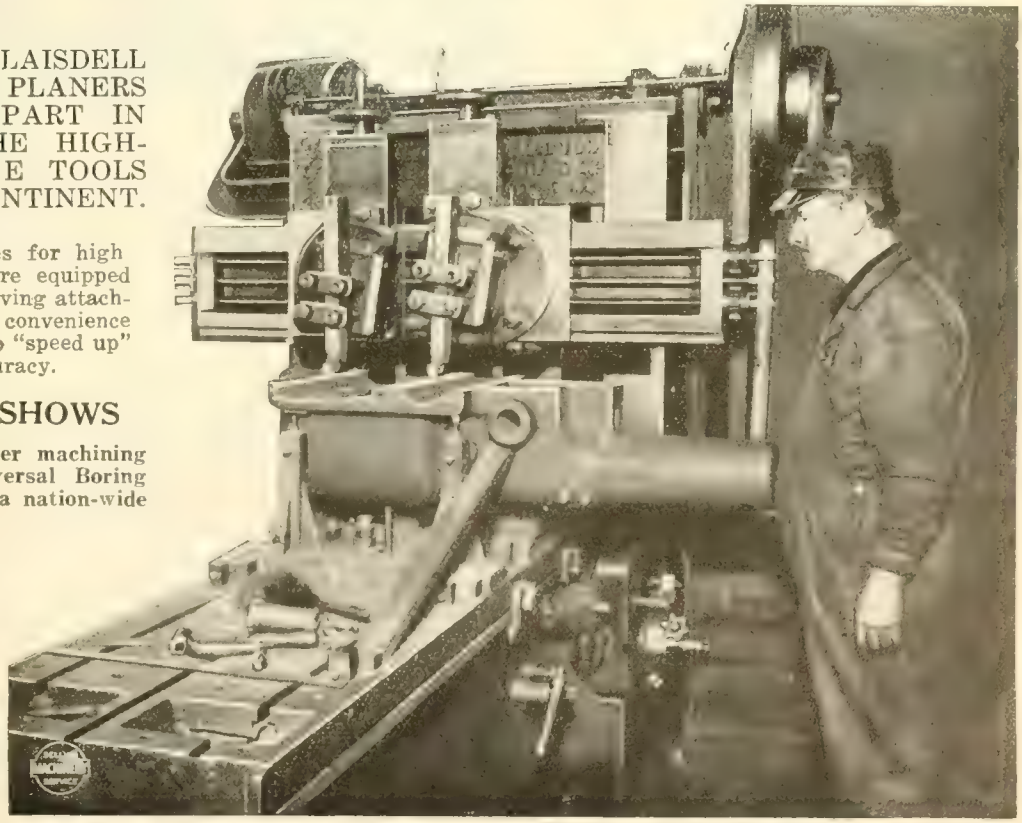
WHITCOMB-BLAISDELL LATHES AND PLANERS PLAY SOME PART IN THE MOST OF THE HIGH-GRADE MACHINE TOOLS MADE ON THE CONTINENT.

ALL-ROUND machines for high grade work, they are equipped with special labor-saving attachments that add to their convenience and enable the operator to "speed up" without endangering accuracy.

ILLUSTRATION SHOWS

a Whitcomb-Blaisdell Planer machining the head post of a Universal Boring Machine—a machine with a nation-wide reputation for accuracy.

May we send you our catalogue giving full particulars?



Whitcomb-Blaisdell Machine Tool Co.
WORCESTER, MASS. U.S.A.

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"The Marshalltown Throatless Shears"

guarantee perfect work at less than half the ordinary expense.

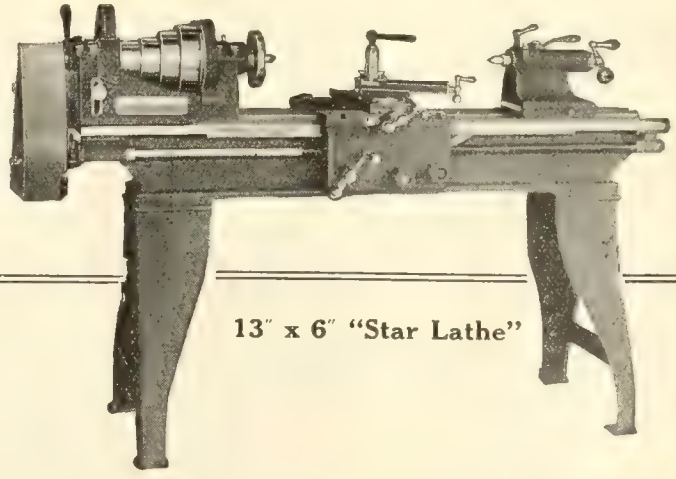
Rotary, self-feeding shears designed for cutting in and out curves, straight or irregular shearing, circles, also beveling and splitting of plates. Built in various sizes having capacities from tin up to ½" thick. No limit to the size of sheet being cut. Hand, belt or motor drives. The last word in metal cutting shears. We also manufacture Rotary Bevel Shears, Splitting Shears and Plate Milling Machines.

Let us know your requirements.

Marshalltown Mfg. Co.

Marshalltown, Iowa
U. S. A.

"STAR" Lathes



13" x 6" "Star Lathe"

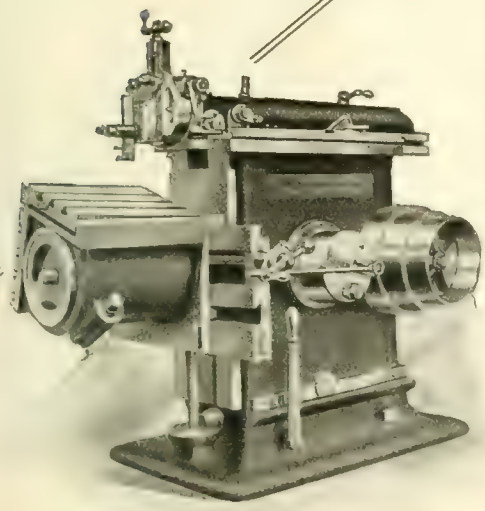
The Tool that makes Garage Work and General Repair Work more Profitable

This is a remarkably sturdy lathe for its size, and its ease of operation, handiness, and accuracy all make it an invaluable tool. It does the work of larger and costly machines at a much lower cost.

Write for our new Circular

The Seneca Falls Mfg. Company, Inc.

366 W. Falls St., SENECA FALLS, N.Y.



UNIVERSAL SHAPING MACHINES

15-INCH STROKE
24-INCH STROKE

The UNIVERSAL feature of these machines eliminates the necessity of special vises, fixtures, etc., and makes them especially adapted for——

Die Work—Tool Making — General Manufacturing Purposes.

Machines regularly furnished with:

Swivelling Graduated Table.
Auxiliary Tilting Side for Compound Angles.
Power Down Feed on any Angle with any variation of feed.
Automatic Feed Stop.
Graduated Collars on Tool Head Feed Screw and Table Feed Screw.
Swivel Vise and Graduated Base.
Table raised and lowered by power on 24-inch size.

Bulletin No. 38

Canadian Office: **POTTER & JOHNSTON MACHINE CO.**

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Works and Warehouse: Galt, Ont., Canada

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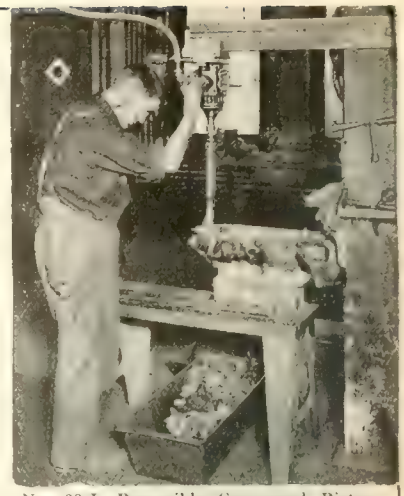
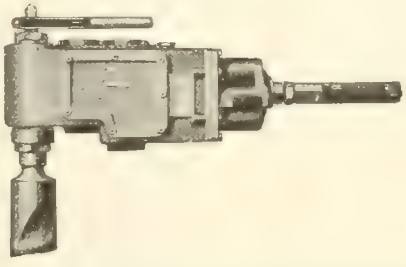
Pneumatic DRILLS and Hammers

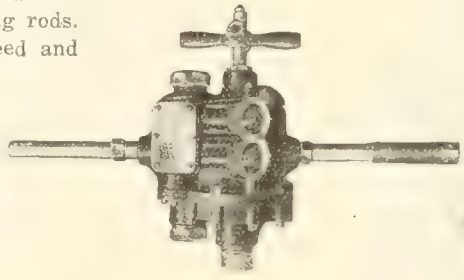
There is a Thor Tool made especially for your work. Try it—and watch it save you time and labor and increase your production.



No. 32-L Reversible Compound Piston Air Drill driving ⅞-inch studs in Motor Crank cases.

Thor are the only air drills made in America having Corliss valves, roller bearings, and one-piece pressed Vanadium steel connecting rods. Also equipped with telescopic screw-feed and removable crank chamber plate.





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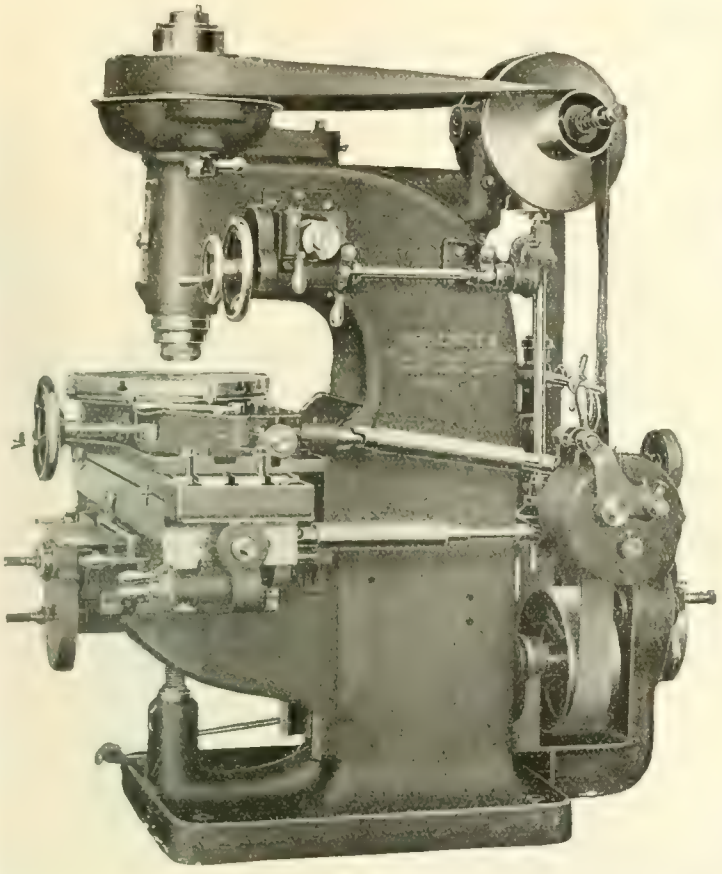

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"THE MACHINE THAT GIVES THE SMOOTH FINISH"

All gear driven spindles lack flexibility and induce vibration through the unavoidable progressive development of back lash between gears resulting in vibration and hammer action which has a crumbling effect upon the cutter teeth and leaves chatter marks on the finished work.

With the Becker Elastic Belt Drive this gearing is eliminated.

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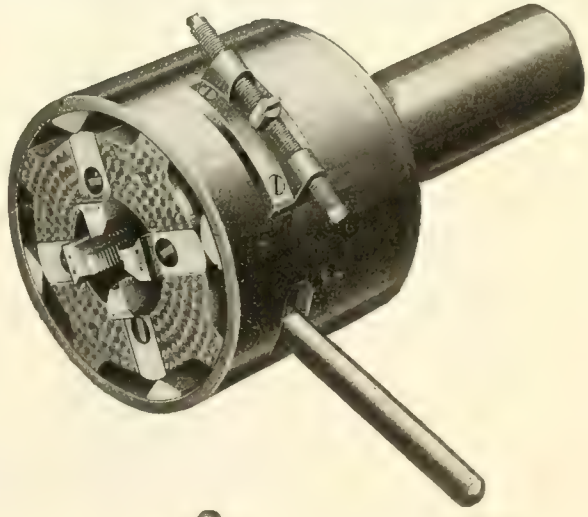
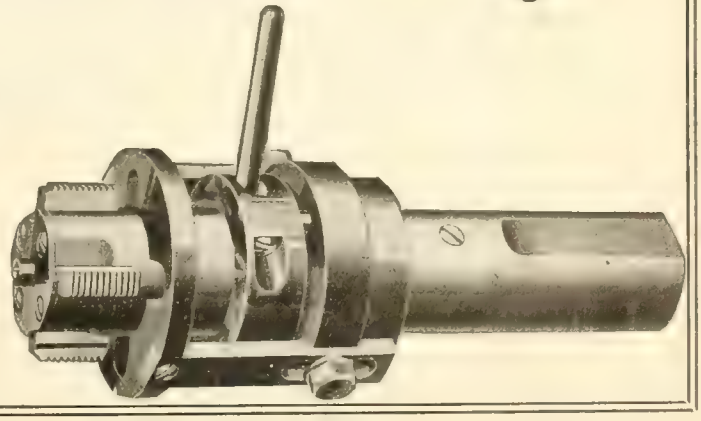
NAMCO DIES TAPS

It doesn't make a bit of difference whether it's threading screws or tapping axle housings, there's a NAMCO Threading Tool for every thread cutting requirement.

NAMCO Dies and Taps are simple in design, rigid in construction to cut threads true to specification on all classes of work.

Ask for catalog--no obligation





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Makers of Gridley Single and Multiple-Spindle Automatics at Windsor, Vermont, and Acme Automatics, Threading Dies, and Screw Machine Products, at Cleveland, Ohio

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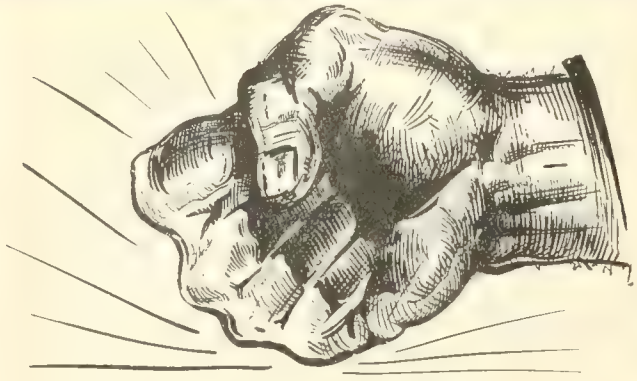
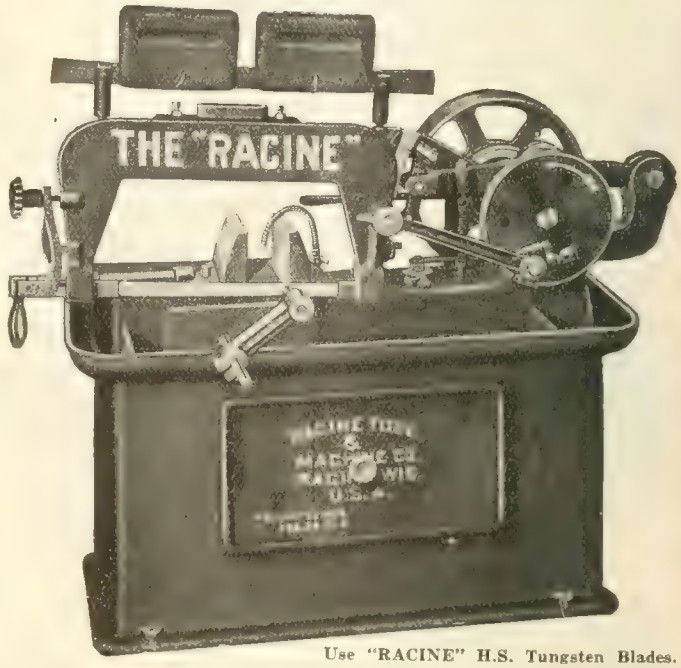


THE "RACINE"

puts PUNCH into Metal Cutting Operations



HAVE you a metal cutting proposition that needs more driving force? The "RACINE" High Speed Metal Cutting Machine is the machine you need! No other machine can approach it for putting **punch** into production. Patented automatic lifting device raises the blade on the return stroke, preventing dragging and strain on the non-cutting stroke. This means greater cutting speed as well as a saving in blades and a saving in power. **Can you afford to operate any other machine?**

With the "RACINE" use H.S. Tungsten Power Blades.

Standard the World Over

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Use "RACINE" H.S. Tungsten Blades.

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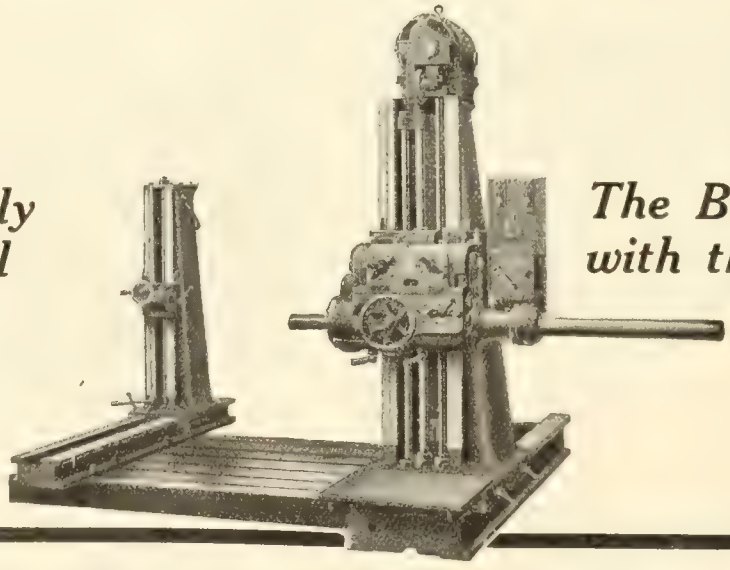

The Boring Machine with the Powerful Spindle

DURABILITY (Defined) — Columns Sidebraced

in two directions and well proportioned for rigidity. Floor plate and runways of solid web construction and very stiffly ribbed. Bearings of high grade bronze, Gears and Shafts of chrome nickel steel and specially heat-treated—these are the features which contribute to the unequalled DURABILITY of this machine.

A machine possessing such DURABILITY and capable of as many as seven different operations on large work with only one chucking is the machine for intensive production.

Our Boring Machine Catalog gives complete data.

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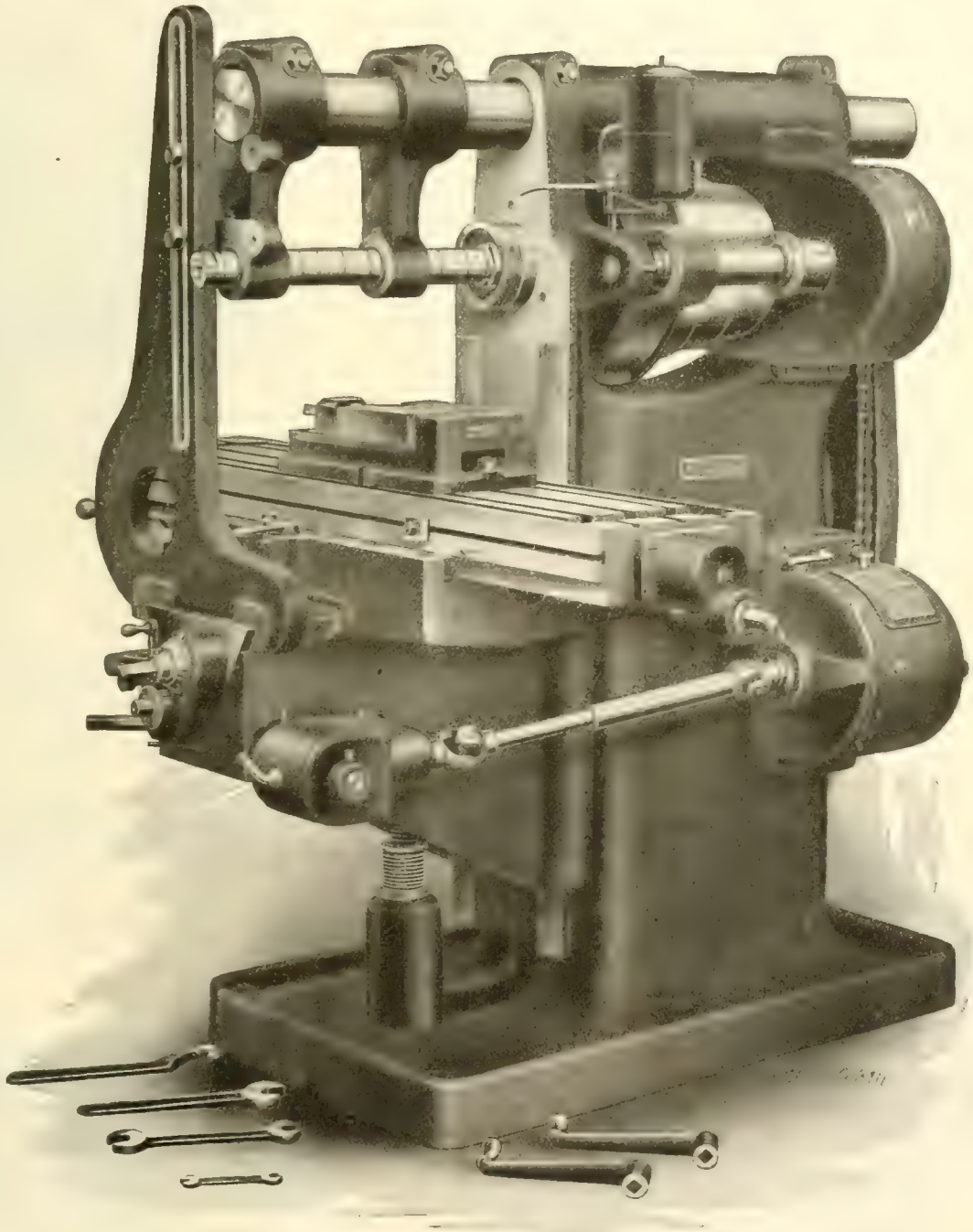
KEMPSMITH



KEMPSMITH No. 3 Plain Milling Machine

Double Back Geared.

A heavy, powerful tool with double back gears and wide driving belt running on a three-step cone of large diameter. Our catalogue "B" describes and illustrates many notable features of the Kempsmith Miller. Write for a copy to-day.

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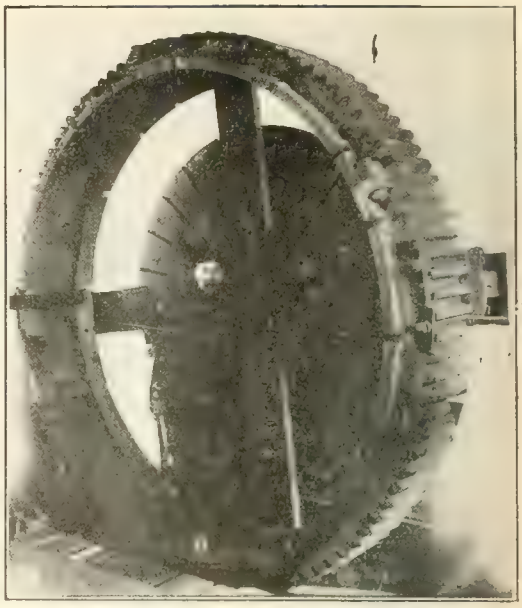

"HISCO" Moulded Gears

WHY pay for expensive patterns when you install new machinery that necessitates special gears? "HISCO" machine-moulded gears, while requiring no pattern, insure accuracy, dependability, quality, and the price is minus the cost of patterns—which in these days of high prices of lumber and labor is something to be considered.

THE "HISCO" plant is equipped to produce machine-moulded gears up to 18 feet in diameter without patterns—and remember, very often the pattern costs more than the gears. *Write for our Estimates.*

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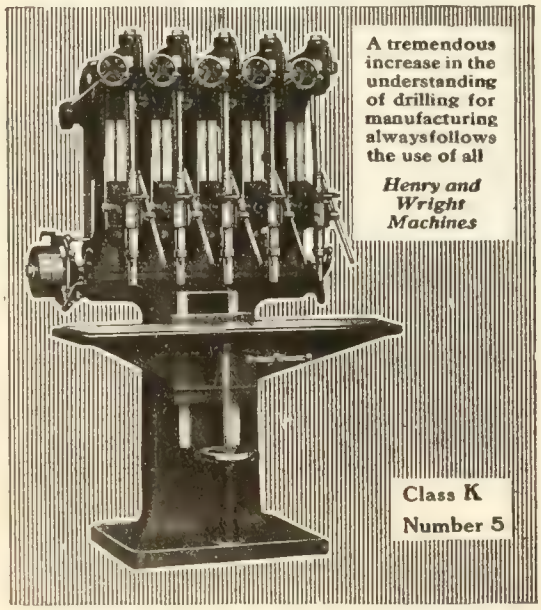
HENRY & WRIGHT

Drilling Machines


A tremendous increase in the understanding of drilling for manufacturing always follows the use of all
Henry and Wright Machines
Class K
Number 5

The Henry & Wright Mfg. Co.

Hartford, Conn.

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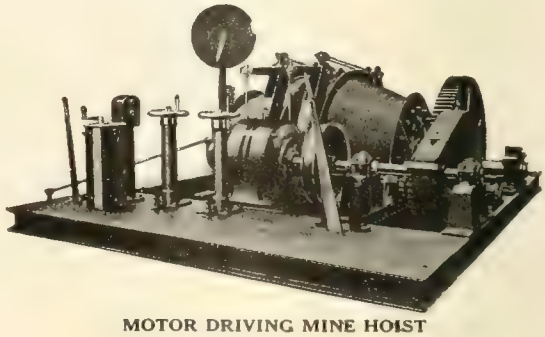

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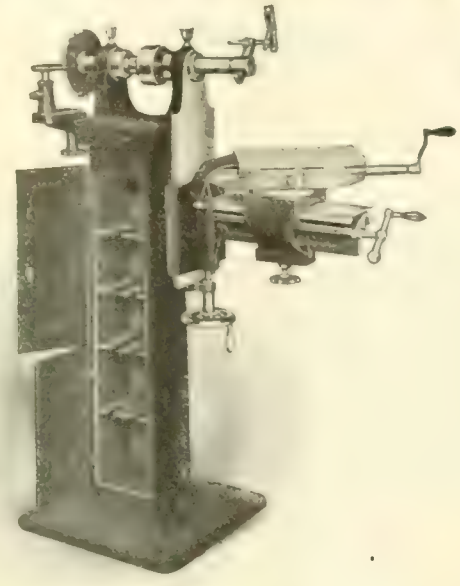
OBTAIN THE BEST RESULTS

From Cutters and Tools Kept Sharp on

GARVIN No. 3 UNIVERSAL

CUTTER AND SURFACE GRINDERS

Simple Light Running Accurate



GARVIN No. 3, Universal Cutter and Surface Grinder
Use Code—Banish

The spindle is hardened and ground and supported out close to the wheel by an extended bearing, and carefully protected from emery.

The knee and the yoke carried on the knee both have a large range of adjustment. On the knee yoke or carriage is mounted the swiveling table, which has a quick, sensitive movement by rack and pinion operated from end or side.

On this table is mounted the index head, and all the attachments are held in this head.

An outfit of emery wheels, mandrels, bushings, wrenches, etc., is supplied with the machine.

Machine is designed to keep its original factory accuracy.

CAPACITY: CUTTERS, 14" x 6"; SURFACES, 9½" x 6"

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IMMEDIATE DELIVERIES

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Manufactured by

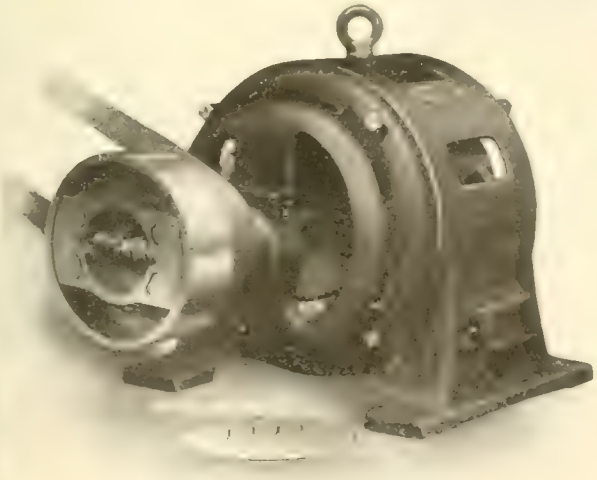
THE GARVIN MACHINE COMPANY

Spring and Varick Streets (*Visitors Welcome*) 50 Years New York City

Centrifugal Friction Clutches

To Ensure the Easy Starting of A.C. & Squirrel Cage Motors

½ H.P. to 1500 H.P.



No Motor Should be Without This Simple and Unique Device.

Entirely Dispenses With all Starting Difficulties

The Clutch also Effects a Great Saving in Current Consumption and Reduces the Initial Cost of Motor and Switchgear.

Please Mention Speed and H.P. of Motor When Sending Enquiries and State the Current Supply.

Write for Catalogues and Full Particulars

Thomas Broadbent & Sons, Limited

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A Plant Equipped in Every Detail to Suit Your Every Need

STEEL PRODUCTS

Open Hearth, Basic and Acid, Electric and Alloy Steels.

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For Ships, Railways, Rolling Mills, Gears, Machinery and Ingots to 35 tons.

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Plates and Heavy Sheets to 30 inches wide, Soft and High Carbon, Automobile Plates and Sheets.

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Soft Centre and Solid Plow Steel, Harrow Discs, Shovel Steel, Cultivator Blades.

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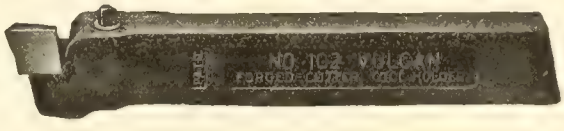

WILLIAMS' "Vulcan" Forged-Cutter Tool Holders give unequalled service to those who prefer the solid, forged-type of cutting tool. Each Holder, by the mere insertion of small High Speed Forged-Cutters is adapted to the heaviest service on Lathe, Planer, etc.

The economy and convenience of this line, when installed as standard shop equipment, is at once apparent, as all blacksmith work, to say nothing of the very considerable investment necessitated by heavy, solid forged-tools of costly High Speed Steel, is eliminated.

Absolutely simple in construction, yet possessing all the advantages of the solid tool without its expense.

Cutters, drop-forged from the finest grade of High Speed Steel, in stock in a great variety of sizes and types, finished and hardened ready for use. Ask for descriptive booklet.

J. H. Williams & Co., 45 Richards Street, Brooklyn, N.Y.
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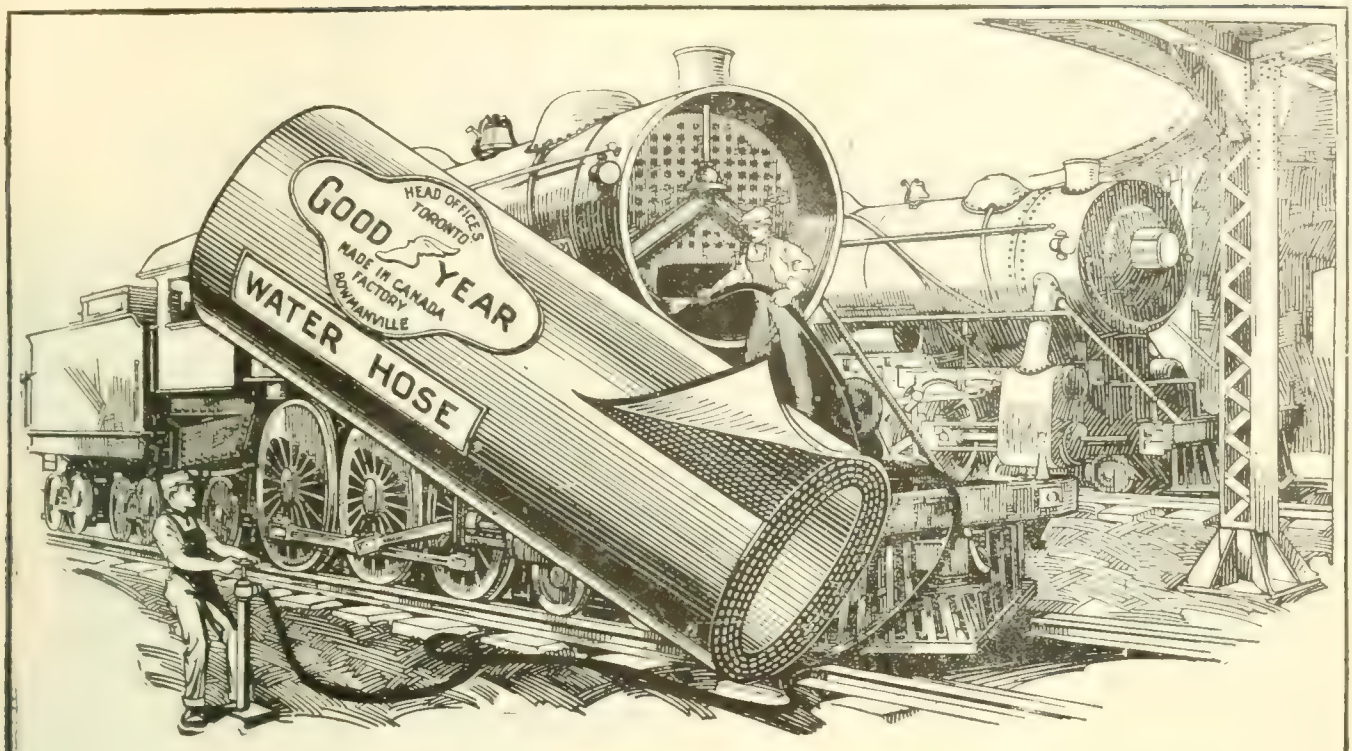
Agents for Manitoba, Saskatchewan, Alberta and British Columbia

Williams' "Vulcan" Forged-Cutter Tool Holders



This Cover Reduces Costs *on Industrial Water Hose*

We never heard of industrial water hose bursting because of internal pressure. Any fairly good water hose will stand all the pressure it will ever get in industrial use.

But we have seen and heard of thousands of feet of water hose which had to be discarded long before its time because the *cover* wore through.

That fact guided Goodyear scientists in designing Goodyear Water Hose.

They started with a good inner tube and strong fabric.

But they put on this hose an unusually thick cover of exceptionally tough rubber.

Water Hose is dragged over floors and pavements and steel plates. It is walked on and run over by hand-trucks and wheelbarrows. It is left outside rain or shine. *The Goodyear cover on Goodyear Water Hose is built to stand this use.*

That is why Goodyear Water Hose wears longer and so costs less.

That is an example of the way Goodyear builds all Industrial Hose—

—finding out what conditions must be met, and then developing the materials and construction to meet them.

Goodyear has scientifically developed a hose for every industrial use. Samples of this hose, and the advice of a trained technical man, are yours for the asking—without obligation. Phone, wire or write the nearest branch.

The Goodyear Tire & Rubber Co. of Canada, Limited

Branches: Halifax, St John, Quebec, Montreal, Ottawa, Toronto, Hamilton, London, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Vancouver

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MADE IN CANADA

INDUSTRIAL HOSE

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Gear Millers
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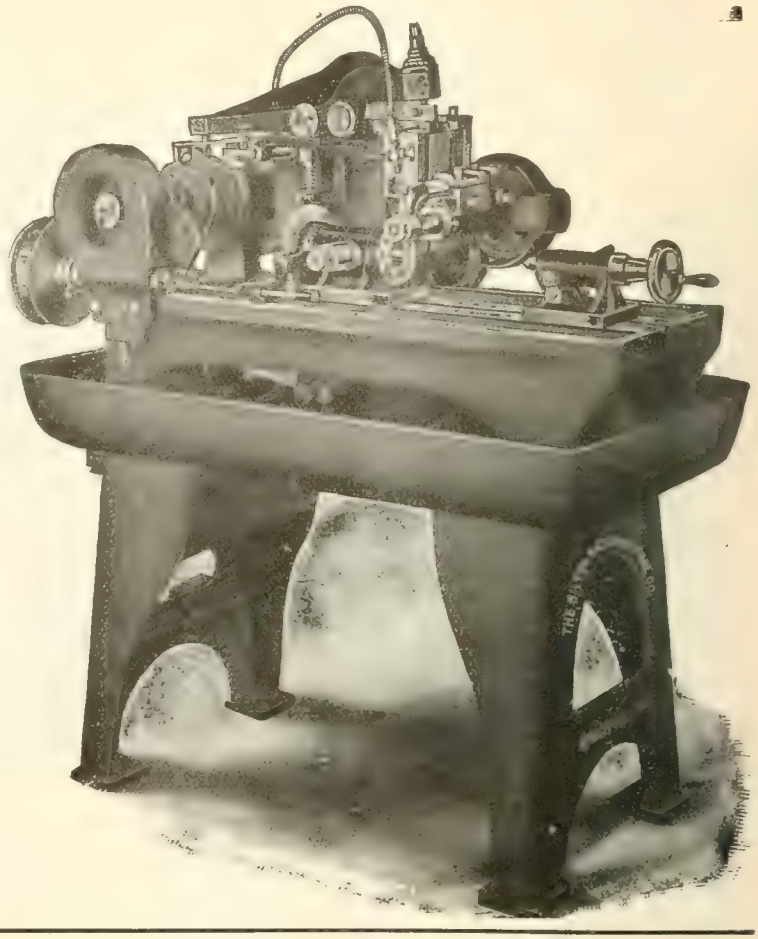
Small Worms



These machines have full automatic action, accurate indexing mechanism, quick releasing arbors or collets.

Let us tell you how they could handle your work.

THE BILTON MACHINE TOOL CO.
Housatonic Ave., Bridgeport, Conn., U.S.A.
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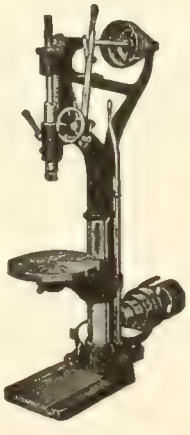
BARNES DRILLS



Complete line. 8-inch to 50-inch swing

Gang Drills.—Horizontal Drills.

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Canadian Agents—A. R. WILLIAMS MACHINERY CO.
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WILLIAMS & WILSON, Montreal

Production of Rare Quality at Lowest Labor Costs

There is unusual strength, accuracy, speed, convenience and range in

AURORA

Drilling Machines

You can use them to great advantage on any work in your shop that's suitable for a machine tool of this kind. The operating is easy and the labor cost comparatively low.

Drop a line for full particulars and specifications.
Stationary Head Sizes 20"—21"
Sliding Head Sizes 22"—44"

The Aurora Tool Works
AURORA, INDIANA, U.S.A.

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

Wherever Pipe is Cut or Threaded Economically

The probability is two to one that it's a

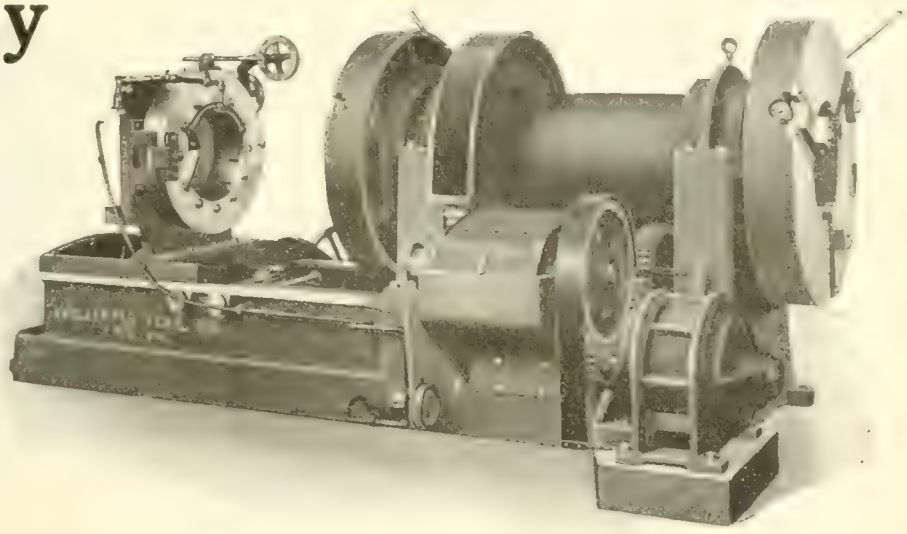
Williams Pipe Machine

that's on the job.

For in approximately two-thirds of all the larger plants in this country Williams' Pipe Machines are used.

It was the Williams Pipe Machine that brought highest honors home from the Panama Exposition.

The Machine illustrated has a capacity of 21½" to 12". Also nine other sizes to meet your requirements.



Write

Williams Tool Company

Erie - Penn. - U.S.A.

Canadian Agents: The A. R. Williams Machinery Co., Limited, Toronto, Canada

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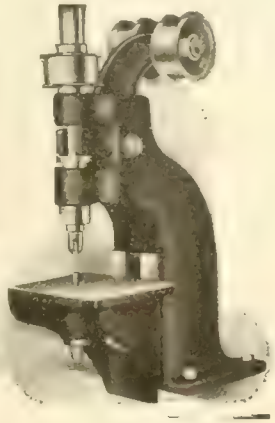
60 Rivets in a Minute

Faster if the work can be fed faster.
But at least 60 every minute.
And in tightest corners just as fast. Every head just as smooth. Not a bent shank; not a tool mark on either rivet head or casting.

GRANT

Rivet Spinning Machines

handle any rivet up to ½-in. shank.
If Grant-made, every hard steel rivet is finished as smooth and as true as every rivet of soft brass.
The Grant Book called "Perfect Riveting" tells how to give an extra appearance of quality to your product. For your copy



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GRANT MFG. & MACHINE COMPANY

Holland Avenue, Bridgeport, Conn.

Wire Cloth

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We make **Machinery Guards** of all kinds.

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Drop a line for full details.

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Note On Grinding

NORTON COMPANY WORCESTER, MASS.

No. 53A

OPERATING SPEEDS FOR SNAGGING CASTINGS

GENERALLY SPEAKING, the correct speed for grinding wheels in snagging castings is between 5,000 and 6,000 surface feet per minute. This is fairly well established and quite generally accepted by the manufacturers of grinding wheels. This range was determined partly by years of experience and partly by physical laws and the desire for an adequate factor of safety. All snagging wheels made by reliable manufacturers are subjected to a speed test just before they are packed for shipment that generates a centrifugal stress many times in excess of the stress prevailing under the recommended operating speed. In the case of the Norton Company, this tested factor of safety runs from 2¼ to 3¼. This, then, is the first limiting factor to wheel speed.

Furthermore, it has been shown that there is no appreciable gain from faster speeds; at least, not enough to offset certain drawbacks. It should be further remembered that the grinding wheel is made to operate at approximately the recommended speeds and any appreciable deviation calls for adjustments that are not always easy to make nor are they conducive to efficiency.

It is necessary to keep the speed of the grinding wheel approximately within the recommended range, if its productive capabilities are to be maintained. It has been demonstrated that if a wheel's speed is allowed to fall to a very low level, or if it is speeded up beyond a certain point, reduced cutting ability for the same amount of effort expended is the result. In the case of a sub-normal wheel speed, not only does the productive capacity fall off, but there is excessive wheel wear.

To illustrate this point, let us consider the case of an 18-in. wheel, grain 10, grade U Alundum, for snagging steel castings. At 1,175 revolutions per minute its peripheral speed is 5,500 surface feet per minute, and it cuts and wears satisfactorily. If the revolutions remain the same, at 11 inches diameter, the surface speed is 3,500 feet. What is the result? Every cutting grain on the face of a revolving grinding wheel has a definite amount of energy stored up in it. It is the expenditure of this energy that enables the grain to do useful work and remove metal. Now the energy available varies as the square of the surface speed. Therefore, at 11 inches diameter, the cutting grains deliver only 40 per cent. of the energy that they did at 18 inches diameter and they cannot be expected, therefore, to grind as rapidly. Also, because of the decreased energy it is less capable of withstanding the resistance offered by the steel and hence is more readily torn from its setting. This, then, explains the difficulty that will be encountered in attempting to grind at very low surface speeds.

In order to keep this same wheel operating at highest efficiency, the wheel speed should be increased at about 13 inches to 1,700 revolutions per minute. By doing this the surface speed as the wheel wears from 18 to 13 inches varies from 5,500 to 4,000 surface feet per minute, and in wearing from 13 to 9 inches the variation is from 5,700 to 4,000.

If this same 10 grade U Alundum wheel was giving satisfaction at 5,700 surface feet per minute and an attempt were made to speed it up to 7,000 surface feet, no greater production would be realized. This is due to the glazing effect resulting from the increased duty imposed on each abrasive grain.

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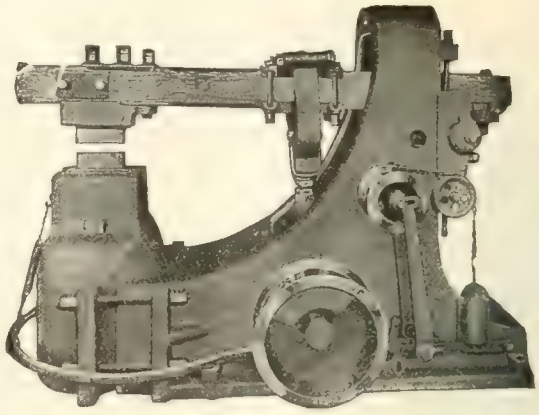

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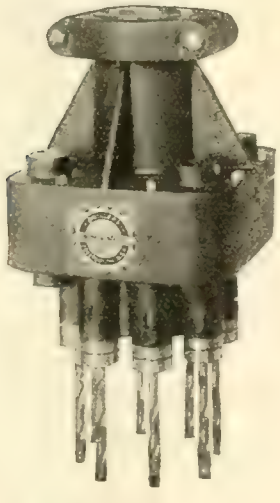

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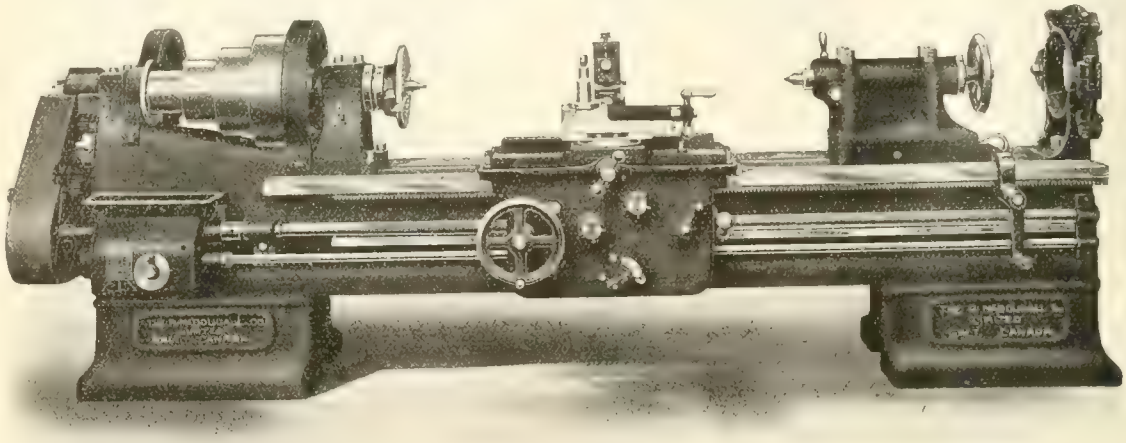

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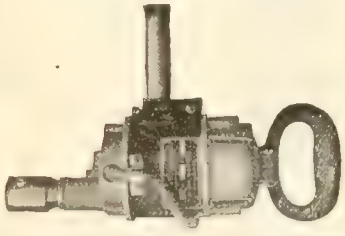

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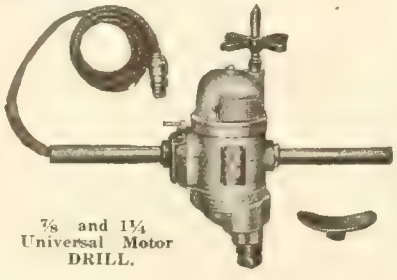

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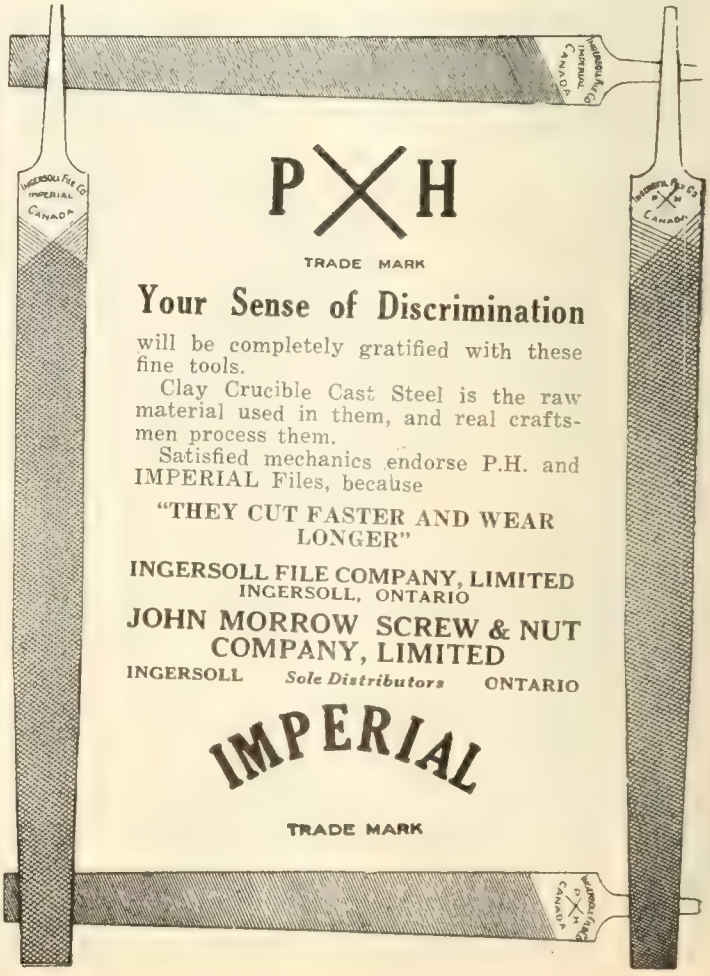

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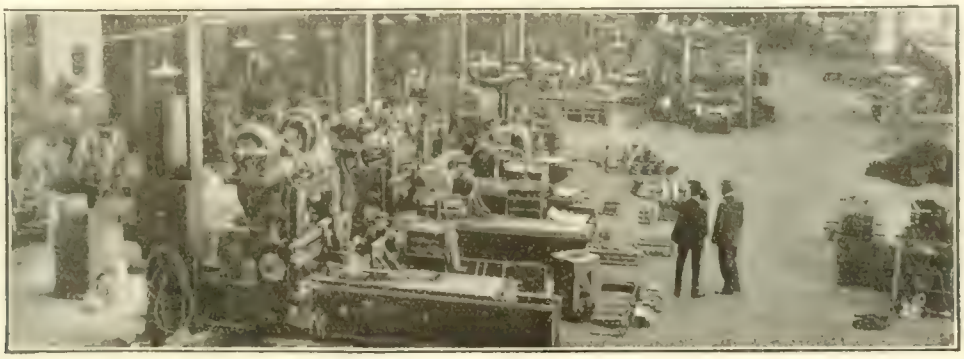

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CANADIAN MACHINERY
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MANUFACTURING NEWS

Vol. XXII. No. 24 December 11, 1919

Broaching as an Aid to Greater Production

The Second of a Series on This Subject. The Combinations Used in the Production of Broaching Work, Together With Views of Various Types of Broaching Machines, Are Described Herein

By FRANK H. MAYO

HAVING described in the previous section of this article some of the details and variations of design incident to broaching, a few illustrations showing combinations used in the production of broached work are here shown, also various types of broaching machines are shown, of which Fig. 14 illustrates a draw broaching machine of the type commonly employed for pulling a broach through the work. This machine is made in a number of sizes, and operates horizontally in the following manner:

A nut A is caused to revolve forward and reverse by means of gears and clutch, and this nut draws the screw B transversely forward and back; at C, a tool slide is attached to the screw, and to this slide the broaches are attached. The work is held against the face plate D, or in a suitable fixture, and the broaches, operating through this plate, broach the work inside or on the outside, as the case may be. On some types of broaching machines, in place of a nut and screw, a rack and pinion are used to draw the broach; the principle involved in such a construction is illustrated by Fig. 15, where the pinion A, travelling forward and reverse, operates the rack B, which has attached to it at C a tool slide. By the use of either

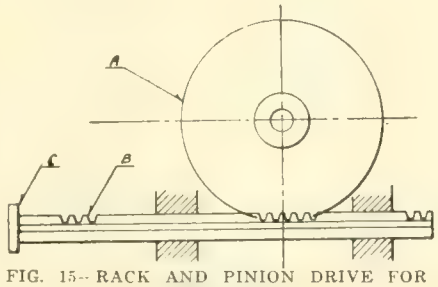


FIG. 15—RACK AND PINION DRIVE FOR BROACH

of these machines, the broaches are drawn slowly through the work at the proper cutting speed, and a quick return for the same is provided by the gearing and reversing mechanism. It is claimed for the screw-and-nut arrangement, that it is smoother acting than when a rack and pinion are used, and the screw and nut is the construction most universally employed.

In Fig. 16, a type of machine used for cutting keyways is illustrated. This is a vertical-stroke machine, and works more on the principle of a slotter. The work is held on the upper plate A, while the cutter bar B is operated from below by suitable reciprocating mechanism.

A very cheap machine often resorted to for an occasional job of broaching on small work is the arbor press, and Fig. 17 shows a small bench press where the work is held on A, either in a fixture or not, while the broaches, which are usually short, are pushed through by the ram B, which is in turn operated by the lever C attached to a pinion that meshes in a rack on the ram. This illustrates the principle of push broaching, whether it be carried out on a punch press, hydraulic press, or any common type of press.

A small horizontal push broaching machine, having a screw and nut as the operating medium, is shown by Fig. 18. This takes the form of a bench lathe, the work A being gripped in a chuck B, which is held to a stationary spindle; this spindle has a hole in it, through which the broaches pass. The broaches

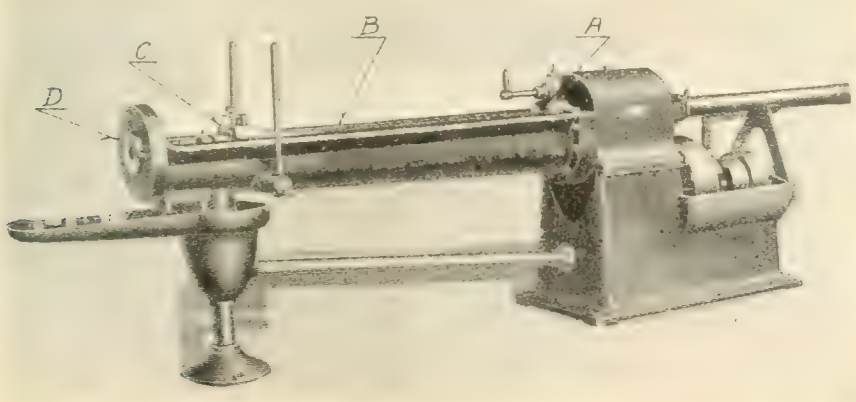


FIG. 14—BROACHING MACHINE USED FOR DRAW BROACHING.

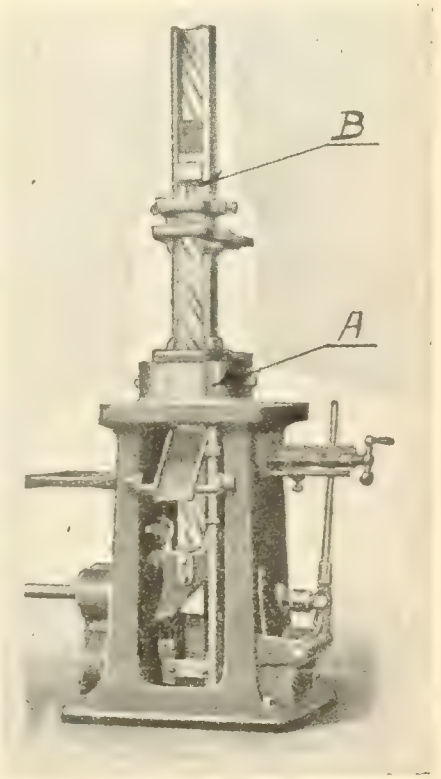


FIG. 16—VERTICAL TYPE OF MACHINE USED FOR BROACHING.

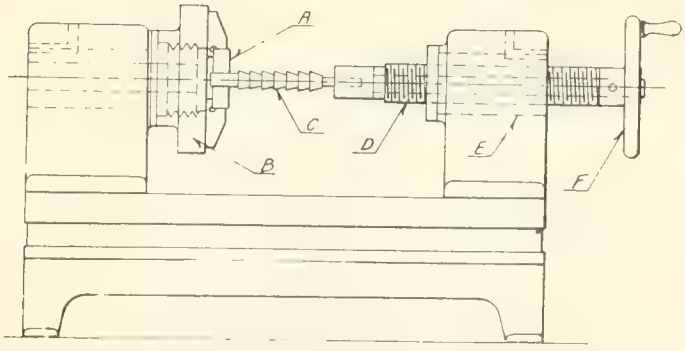


FIG. 18—SMALL PUSH BROACHING MACHINE.

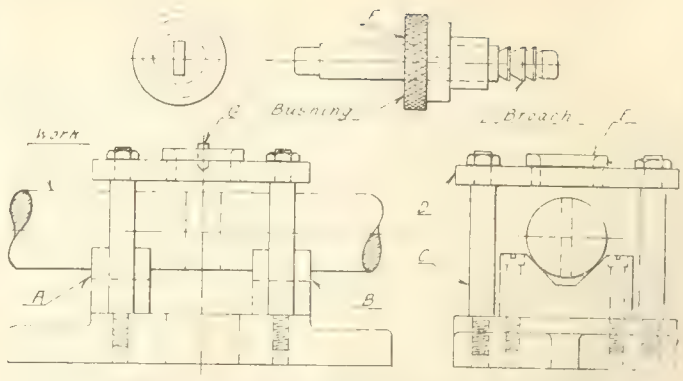


FIG. 19—FIXTURE FOR PUSH BROACHING RECTANGULAR HOLE.

C are pushed through the work by the screw D operating in the fixed nut E, a handwheel F being used to revolve the screw.

Fig. 19 shows a fixture that was used on a press for push broaching, an elongated hole which passes through a round bar, and also illustrates the type of broaches and guide bushings used in this connection. Referring to the illustration, the work is held between two vee blocks A and B, no clamps or other means being used to hold it in place. Four studs C carry a plate D, which contains a fixed bushing E. Slip bushings F, containing different sizes of broaches, are successively put in place in the fixed bushing E, and these broaches have short pilots on them which enter the work and locate it in line with the bushing. This hole is first drilled out and the broaches trim the sides and square the corners of the hole. To locate the slip bushings in the proper radial location, a pin G is provided, which enters a hole in the slip bushings. These broaches have three cutting edges, and the upper portion is a slip fit in the bushing.

For cutting vee slots in the outside

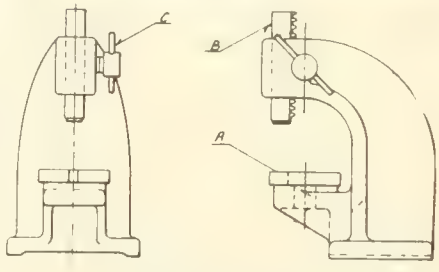
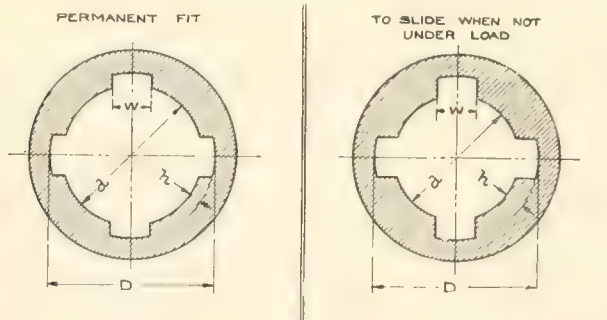


FIG. 17—ARBOR PRESS SOMETIMES USED FOR BROACHING.

of a round piece, a built-up broach, such as that shown in Fig. 20, may sometimes be used to good advantage; this broach is used on a press in connection with four others. The two vee-shaped slots in the work run by the neck, the broaches A are held in a suitable holder B, and the work is pushed through the broaches by the ram of the press. The views at the right of Fig. 20 show how a number of discs (five in this case) are fastened together by screws and dowels, each disc being backed off to form a tooth, thereby making a progressive broach. In the view showing the work in place, the broach illustrated is of the plain type, and would have but one cutting edge, and by comparing this with the built-up type, the advantage of the five cutting edges over the one is readily apparent.

Another feature sometimes incorporated in this style of external broach, is a recess at the upper end, to act as a pilot when starting the work through the broach. In connection with broaching practice, the tables of splines, Figs. 21, 22 and 23 are of interest, also the table



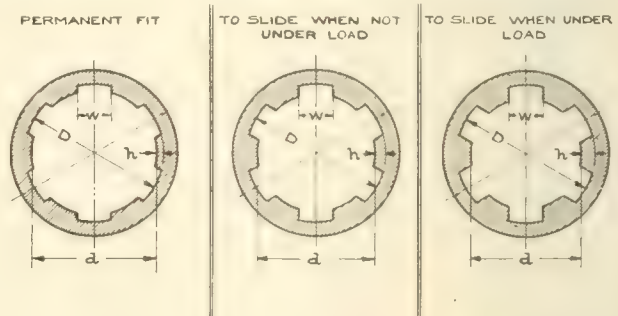
w = .241 D
h = .075 D
d = .850 D

w = .241 D
h = .125 D
d = .750 D

NOMINAL DIA	D	d	w	h	T	D	d	w	h	T
3/4	.750	.637	.181	.056	78	.750	.562	.181	.094	123
	.749	.636	.180	.055		.749	.561	.180	.093	
7/8	.875	.744	.211	.066	107	.875	.656	.211	.109	167
	.874	.743	.210	.065		.874	.655	.210	.108	
1	1.000	.850	.241	.075	139	1.000	.750	.241	.125	219
	.999	.849	.240	.074		.999	.749	.240	.124	
1 1/8	1.125	.956	.271	.084	175	1.125	.844	.271	.141	277
	1.124	.955	.270	.083		1.124	.843	.270	.140	
1 1/4	1.250	1.062	.301	.094	217	1.250	.937	.301	.156	341
	1.249	1.061	.300	.093		1.249	.936	.300	.155	
1 3/8	1.375	1.169	.331	.103	262	1.375	1.031	.331	.172	414
	1.374	1.168	.330	.102		1.374	1.030	.330	.171	
1 1/2	1.500	1.275	.361	.112	311	1.500	1.125	.361	.187	491
	1.499	1.274	.360	.111		1.499	1.124	.360	.186	
1 5/8	1.625	1.381	.391	.122	367	1.625	1.219	.391	.203	577
	1.624	1.380	.390	.121		1.624	1.218	.390	.202	
1 3/4	1.750	1.487	.422	.131	424	1.750	1.312	.422	.219	670
	1.749	1.486	.421	.130		1.749	1.311	.421	.218	
2	2.000	1.700	.482	.150	555	2.000	1.500	.482	.250	875
	1.998	1.698	.480	.148		1.998	1.498	.480	.248	
2 1/4	2.250	1.912	.542	.169	703	2.250	1.687	.542	.281	1106
	2.248	1.910	.540	.167		2.248	1.685	.540	.279	
2 1/2	2.500	2.125	.602	.187	865	2.500	1.875	.602	.312	1365
	2.498	2.123	.600	.185		2.498	1.873	.600	.310	
3	3.000	2.550	.723	.225	1249	3.000	2.250	.723	.375	1969
	2.998	2.548	.721	.223		2.998	2.248	.721	.373	

T = 1000 x 4 x Mean R x h x l = INCH-POUNDS TORQUE CAPACITY PER INCH BEARING LENGTH AT 1000 LBS. PRESSURE PER SQUARE INCH ON SIDES OF SPLINES. NO ALLOWANCE IS MADE FOR RADII ON CORNERS NOR FOR CLEARANCES.

FIG. 21—TABLE OF S.A.E. FOUR SPLINE FITTING.



w = .25 D
h = .05 D
d = 90 D

w = .25 D
h = 075 D
d = .85 D

w = .25 D
h = .10 D
d = .80 D

NOMINAL DIA	D	d	w	T	D	d	w	T	D	d	w	T
3/4	.750	.675	.188	80	.750	.638	.188	117	.750	.600	.188	152
	.749	.674	.187		.749	.637	.187		.749	.599	.187	
7/8	.875	.788	.219	109	.875	.744	.219	159	.875	.700	.219	207
	.874	.787	.218		.874	.743	.218		.874	.699	.218	
1	1.000	.900	.250	143	1.000	.850	.250	208	1.000	.800	.250	270
	.999	.899	.249		.999	.849	.249		.999	.799	.249	
1 1/8	1.125	1.013	.281	180	1.125	.956	.281	263	1.125	.900	.281	342
	1.124	1.012	.280		1.124	.955	.280		1.124	.899	.280	
1 1/4	1.250	1.125	.313	223	1.250	1.063	.313	325	1.250	1.000	.313	421
	1.249	1.124	.312		1.249	1.062	.312		1.249	.999	.312	
1 3/8	1.375	1.238	.344	269	1.375	1.169	.344	393	1.375	1.100	.344	510
	1.374	1.237	.343		1.374	1.168	.343		1.374	1.099	.343	
1 1/2	1.500	1.350	.375	321	1.500	1.275	.375	468	1.500	1.200	.375	608
	1.499	1.349	.374		1.499	1.274	.374		1.499	1.199	.374	
1 5/8	1.625	1.463	.406	376	1.625	1.381	.406	550	1.625	1.300	.406	713
	1.624	1.462	.405		1.624	1.380	.405		1.624	1.299	.405	
1 3/4	1.750	1.575	.438	436	1.750	1.488	.438	637	1.750	1.400	.438	827
	1.749	1.574	.437		1.749	1.487	.437		1.749	1.399	.437	
2	2.000	1.800	.500	570	2.000	1.700	.500	833	2.000	1.600	.500	1080
	1.998	1.798	.498		1.998	1.698	.498		1.998	1.598	.498	
2 1/4	2.250	2.025	.563	721	2.250	1.913	.563	1052	2.250	1.800	.563	1367
	2.248	2.023	.561		2.248	1.912	.561		2.248	1.798	.561	
2 1/2	2.500	2.250	.625	891	2.500	2.125	.625	1300	2.500	2.000	.625	1688
	2.498	2.248	.623		2.498	2.123	.623		2.498	1.998	.623	
3	3.000	2.700	.750	1283	3.000	2.550	.750	1873	3.000	2.400	.750	2430
	2.998	2.698	.748		2.998	2.548	.748		2.998	2.398	.743	

T = 1000 x 6 x Mean R x h x l = INCH-POUNDS TORQUE CAPACITY PER INCH BEARING LENGTH AT 1000 LBS. PRESSURE PER SQUARE INCH ON SIDES OF SPLINES. NO ALLOWANCE IS MADE FOR RADII ON CORNERS NOR FOR CLEARANCES.

FIG. 22—TABLE OF S.A.E. SIX SPLINE FITTINGS.

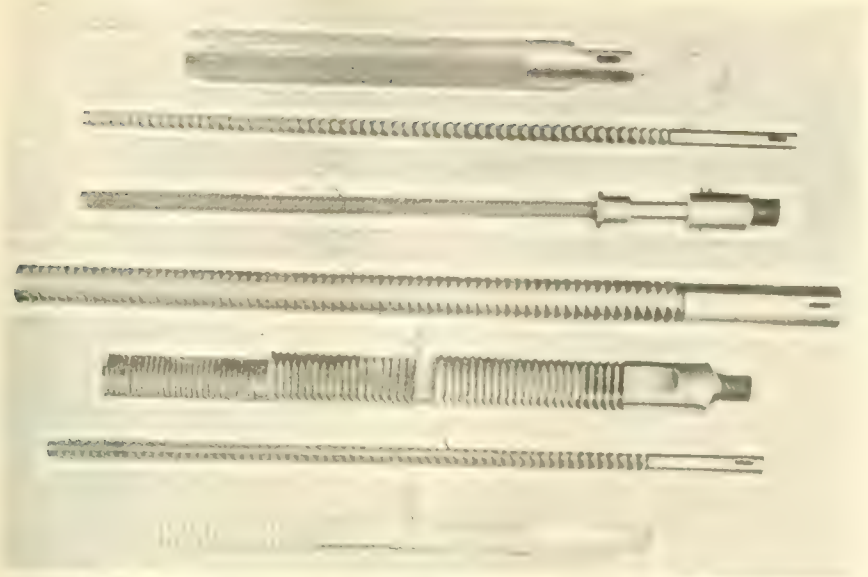


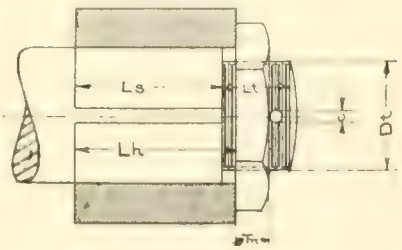
FIG. 20. ILLUSTRATIONS SHOWING VARIOUS TYPES OF BROACHES

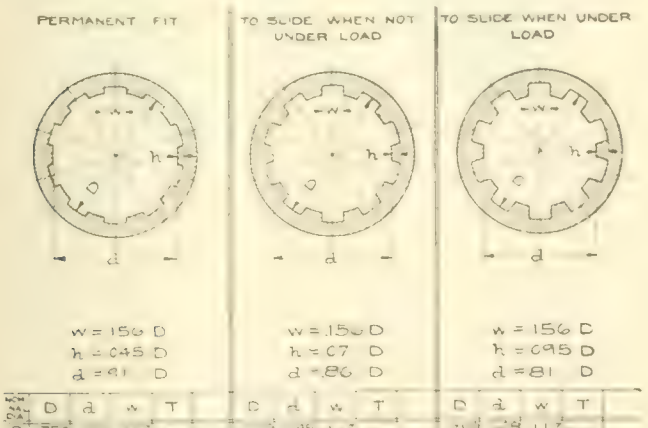
of squares, Fig. 24. These are the Society of Automobile Engineers standard practice, and broaches for cutting the same are carried in stock by some broach makers. In Fig. 21, it will be noticed that the table gives dimensions for four splines to "permanently fit" on a shaft and "to slide when not under load," while the tables, Figs. 22 and 23, give three styles of fit. The table of squares, Fig. 24, gives sizes for "permanent fits," and also for "slip fits."

On draw broaching machines, the tool slide is a very important unit, as it must be very substantially made, and a view of a tool slide is shown by Fig. 25. This illustrates the method of gripping the broach-holding units, which were shown in the first part of this article; this is taken care of by threading them into the sliding block A, which is adjustable, to bring the broach in the proper relation to the work by means of the screw B; a square-headed screw C locks the broach holder, and this illustration shows a split broach holder D in position. Two slots E, one shown and one at the opposite side, fit over slides on the machine and prevent the screw of the machine and slide from turning, while at the same time supporting the slide and broach contained therein. The lug F, which carries the plug G, is so located that it engages with trips which control the travel of the screw on the machine.

A typical group of broaches of varied design are illustrated by Fig. 26, the upper one of which is of the type commonly employed to broach internal gears, it being indicated as A and shaped like a spur gear with teeth increasing from nothing to the full depth of the gear tooth spaces; at B a broach for a hexagonal hole is shown; C illustrates a broach for a round hole to replace a reamer; D is a large square broach; E is a special broach for forming an arc; F is a grooving broach of the type used for cutting splines; while the lower broach G is for finishing a rectangular slot. Broaches of the latter type are frequently made with the teeth on opposite sides, sloping diagonally opposite, as this makes a stronger tool, with the advantage of a shear cut, more teeth are thus working at the same time, and the angles should be so made that they neutralize the side thrust on the broach when cutting.

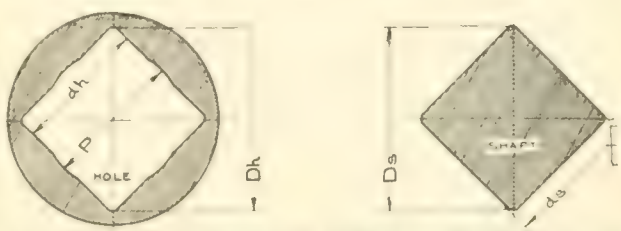
Among the common accomplishments





T = 1000 × C × MEAN R × h × N = NORMAL UNIT TOOTH CAPACITY PER INCH BEARING LENGTH AT 100 LBS. PRESSURE PER SQUARE INCH ON SIDES OF SPLINES. NO ALLOWANCE IS MADE FOR RAD. IN CORNERS NOR FOR CLEARANCES.

FIG. 21. TABLE OF S.A.E. TEN SPLINE FITTINGS



No.	PERMANENT FIT ds/Ds = .80													SLIP FIT ds/Ds = .73					
	P	ds	dh	Ds	Dh	Ls	Lh	Lt	Dt	N	Tn	H	c	Cp	P	ds	dh	Ds	Dh	Cs
4	1.193	.895	.836	.250	.206	5/8	5/8	5/16	3/8	30	5/32	1/4	.1		.257	.1	.1	.343	.1	26
8		.885	.825	.245	.202	5/8	5/8	5/16	3/8		5/32	1/4	.1		.1	.1	.1	.337	.1	
16	2.390	2.832	2.682	.375	.182	7/8	7/8	7/16	1/2	28	7/32	5/16	.1		.386	.1	.1	.506	.1	59
32		2.822	2.672	.370	.177	7/8	7/8	7/16	1/2		7/32	5/16	.1		.1	.1	.1	.496	.1	
1	3.586	3.763	3.740	.495	.252	1 1/8	1 1/8	9/16	5/8	24	9/32	3/8	.1	49	.515	.1	.1	.675	.1	10
32		3.753	3.730	.490	.247	1 1/8	1 1/8	9/16	5/8		9/32	3/8	.1		.1	.1	.1	.665	.1	
16	.33	5.020	.1	.225	.1	1 3/8	1 3/8	11/16	3/4	20	11/32	7/16	.1	6	.643	.1	.1	.843	.1	16
64	.50	.1	.4990	.220	.201	1 3/8	1 3/8	11/16	3/4		11/32	7/16	.1		.1	.1	.1	.8367	.1	
32	.37	5.645	5.565	.745	.1	1 3/4	1 3/4	7/8	1	20	13/32	1/2	.1		.771	.1	.1	.971	.1	23
64	.53	5.635	5.555	.740	.1	1 3/4	1 3/4	7/8	1		13/32	1/2	.1		.1	.1	.1	.961	.1	
16	.75	5.645	5.565	.745	.1	1 3/4	1 3/4	7/8	1	20	13/32	1/2	.1		.771	.1	.1	.971	.1	32
64	.91	5.635	5.555	.740	.1	1 3/4	1 3/4	7/8	1		13/32	1/2	.1		.1	.1	.1	.961	.1	
32	.75	5.625	5.475	.875	.1	2 1/8	2 1/8	1 1/16	1 1/4	20	15/32	9/16	.1		.899	.1	.1	1.087	.1	42
64	.91	5.615	5.465	.870	.1	2 1/8	2 1/8	1 1/16	1 1/4		15/32	9/16	.1		.1	.1	.1	1.082	.1	
1	2.27	5.55	5.25	.1	.1	2 1/2	2 1/2	1 1/4	1 1/2	20	17/32	5/8	.1	176	.1	.1	.1	.1	.1	53
32	.45	5.495	5.115	.1	.1	2 1/2	2 1/2	1 1/4	1 1/2		17/32	5/8	.1		.1	.1	.1	.1	.1	
16	.59	5.870	5.750	.25	.45	3	3	1 1/2	1 3/4	20	19/32	3/4	.1		.271	.1	.1	.542	.582	64
32	.67	5.870	5.740	.120	.10	3	3	1 1/2	1 3/4		19/32	3/4	.1		.1	.1	.1	.534	.557	
1 1/4	1	.393	.1	.250	.277	3 1/8	3 1/8	1 5/8	1 7/8	20	21/32	13/16	.1	260	.1	.1	.1	.687	.707	64
32	1.002	.445	.245	.245	.272	3 1/8	3 1/8	1 5/8	1 7/8		21/32	13/16	.1		.1	.1	.1	.682	.702	
1 3/8	1 5/32	.28	.25	.375	.1	3 7/8	3 7/8	2	2 1/4	20	23/32	7/8	.1	350	.1	.1	.1	.875	.895	74
32	.17	.24	.235	.370	.1	3 7/8	3 7/8	2	2 1/4		23/32	7/8	.1		.1	.1	.1	.868	.888	
1 1/2	1 5/32	1.128	.27	.500	.380	4 3/8	4 3/8	2 1/4	2 1/2	20	25/32	15/16	.1	450	.1	.1	.1	1.062	1.082	94
32	.27	.27	.24	.495	.375	4 3/8	4 3/8	2 1/4	2 1/2		25/32	15/16	.1		.1	.1	.1	1.057	1.077	
1 3/4	1 5/32	.378	.335	.745	.645	5 1/8	5 1/8	2 5/8	2 7/8	18	27/32	1 1/16	.1	540	.1	.1	.1	1.312	1.335	28
32	.27	.377	.334	.740	.640	5 1/8	5 1/8	2 5/8	2 7/8		27/32	1 1/16	.1		.1	.1	.1	1.307	1.330	
2	2 5/32	.504	.1	.720	.1	5 7/8	5 7/8	3	3 1/4	18	15/16	1 1/8	.1	800	.1	.1	.1	1.562	.1	168
32	.13	.503	.445	.715	.635	5 7/8	5 7/8	3	3 1/4		15/16	1 1/8	.1		.1	.1	.1	1.557	1.577	
2 1/4	2 13	.754	.15	.1	.1	6 5/8	6 5/8	3 3/8	3 3/4	18	1 1/16	1 1/4	.1	940	.1	.1	.1	1.812	1.837	210
32	.13	.753	.665	.965	.885	6 5/8	6 5/8	3 3/8	3 3/4		1 1/16	1 1/4	.1		.1	.1	.1	1.807	1.832	
2 1/2	2 5/32	2.004	2.000	.500	.1	7 3/8	7 3/8	3 3/4	4 1/8	16	1 3/16	1 3/8	.1	1050	.1	.1	.1	2.062	2.092	263
32	.17	2.004	1.940	.495	.1	7 3/8	7 3/8	3 3/4	4 1/8		1 3/16	1 3/8	.1		.1	.1	.1	2.057	2.087	
2 3/4	2 5/32	2.254	2.250	.500	.1	8 1/8	8 1/8	4 1/8	4 1/2	16	1 5/16	1 1/2	.1	1250	.1	.1	.1	2.312	2.342	315
32	.17	2.254	2.190	.495	.1	8 1/8	8 1/8	4 1/8	4 1/2		1 5/16	1 1/2	.1		.1	.1	.1	2.307	2.337	
3	2 5/32	2.504	2.500	.500	.1	8 7/8	8 7/8	4 1/2	4 7/8	16	1 7/16	1 5/8	.1	1500	.1	.1	.1	2.562	2.592	379
32	.17	2.504	2.440	.495	.1	8 7/8	8 7/8	4 1/2	4 7/8		1 7/16	1 5/8	.1		.1	.1	.1	2.557	2.587	
3 1/2	2 5/32	2.754	2.750	.500	.527	9 5/8	9 5/8	4 7/8	5 3/8	16	1 9/16	1 3/4	.1	2200	.1	.1	.1	2.812	2.842	514
32	.17	2.754	2.690	.495	.522	9 5/8	9 5/8	4 7/8	5 3/8		1 9/16	1 3/4	.1		.1	.1	.1	2.807	2.837	
4	2 5/32	3.254	3.250	.500	.1	10 3/8	10 3/8	5 1/4	5 7/8	16	1 11/16	1 7/8	.1	2800	.1	.1	.1	3.312	3.342	672
32	.17	3.254	3.190	.495	.1	10 3/8	10 3/8	5 1/4	5 7/8		1 11/16	1 7/8	.1		.1	.1	.1	3.307	3.337	

FIG. 23. TABLE OF A.S.E. SQUARE FITTINGS.

FIG. 25 –METHOD OF ADJUSTING BROACH. PORTABLE DRILL PRESS.

across flats required at both ends; this forms a bearing for the work on the plug, as it is successively indexed about the same.

An example of broaching out a sliding gear is shown by Fig. 28. In this instance, it is necessary to remove considerable metal at both sides of the key portion, as indicated at A. To accomplish this, the work is held against the face plate of a draw broaching machine in the usual manner while a long broach is pulled through it, and a section through this broach at three points are shown in the upper row; the first section

By referring to Fig. 29, an idea may be had of the construction of a broach holder for cutting six keyways at the same time. This is held to the tool slide of the machine in the usual manner, and the holder portion A has slots cut in it to receive the broaches B, while a ring C forced over the holder contains six screws D, which securely hold the broaches in place, the broaches being made with a hook shape at X so the pull of the cut will come against solid metal.

In the final section of this article, examples of spiral and group broaching will be shown, which, together with what has already been said, forms quite an extensive description of the broaching practice, which for quickness of re-

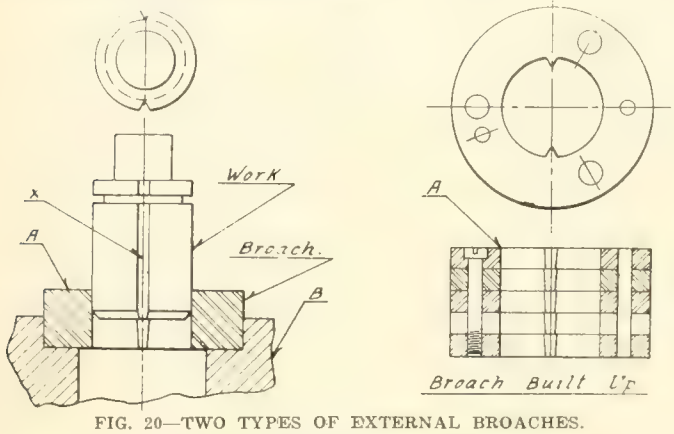


FIG. 26—TWO TYPES OF EXTERNAL BROACHES.

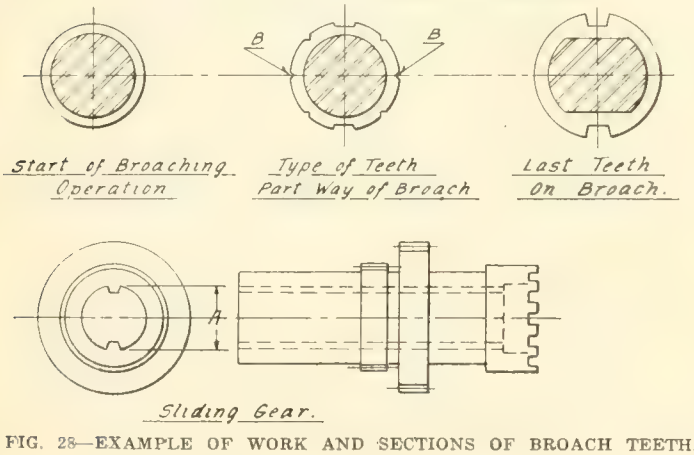


FIG. 28—EXAMPLE OF WORK AND SECTIONS OF BROACH TEETH.

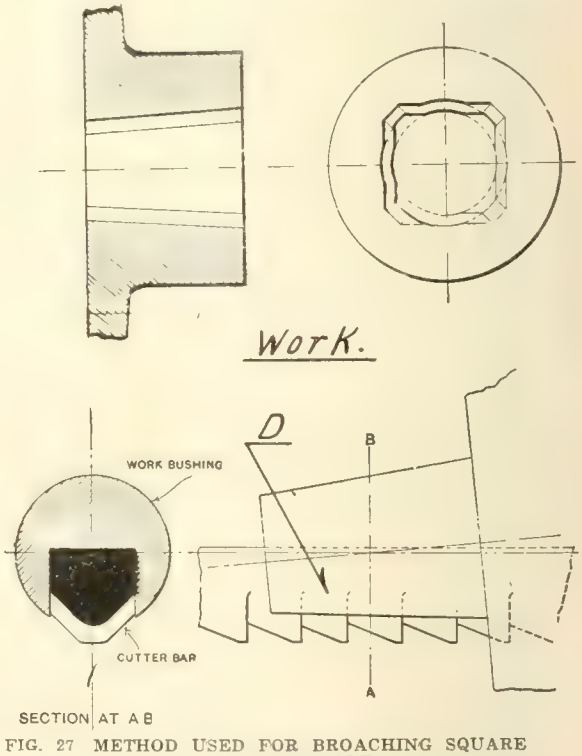


FIG. 27 METHOD USED FOR BROACHING SQUARE TAPERED HOLE.

of broaching practice are listed broaching keyways in a tapered hole and broaching tapered square holes. Referring to Fig. 27, this shows an example of work broached with a tapered square in it, while below, the method of holding the work for this operation is shown. It will be noted in this connection that the work is held on an angle, so as to bring the line D parallel with the screw of the machine. To machine, by broaching, this tapered hole, it is necessary to provide an indexing fixture arrangement so the work may be indexed four quarter revolutions, thus alternately bringing the four corners of the work in the correct location, so that when the broach, which is made to trim out the corners and part way across two sides, is drawn through four times, the holes will be completed. The general practice in this connection is to have the work supported by the round-tapered plug in a hole reamed slightly larger than the distance

shows the round shank of the broach through the groove of the first tooth; the next section shows how the teeth are nicked at B to break the chips; while the last section shows one of the finishing teeth, where it will be noticed flats have been cut across the broach grooves to provide additional chip room, as the finishing teeth not only cut out between the key portion of the work but also trim the sides of the same.

sults is rivalled only by the punch press, the chief disadvantage of broaching being the first cost of the tools and the uncertainty incidental to the length of time they will stand up on the job.

The Chemical Products Corporation, Ltd., Toronto, are considering the erection of a plant in Belleville at an estimated cost of $1,000,000.

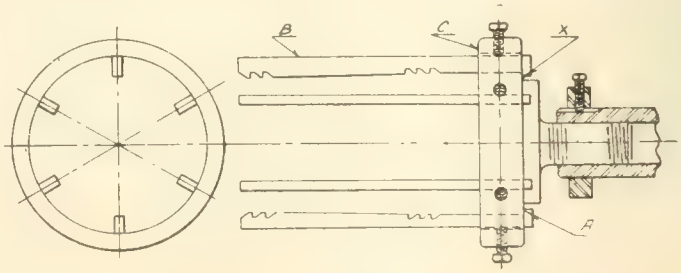


FIG. 29—HOLDER AND BROACHES FOR CUTTING SIX SLOTS.

What is the Mechanical Engineer's Position?

Some Excerpts From an Address Read Before the Institution of Mechanical Engineers on Administration and Organization, With the Danger of Further Encroachments Upon Their Established Position in the Engineering World

By EDWARD HOPKINSON, D. Sc., President

IF we are to maintain, or perhaps I should say if we are to prevent, further encroachments upon our established position in the engineering world, mechanical engineers must give more attention to the administration and organization of workshops. We have omitted to realize that to make an efficient machine is one thing, but to make it efficiently another thing. . . . The exigencies of war have taught us much, and have, I think, brought to the fore a considerable number of young engineers of natural administrative and organizing capacity. But administration and organization cannot be left entirely to natural aptitude, even when combined with long experience. There can be little doubt that in the future our shops must be managed by younger men, of more limited personal experience than has been customary hitherto, who will therefore need to rely to a greater extent upon the experience of others, acquired through reading and lectures. These questions of management and organization are vital matters which ought not to be left to chance, and should form part of the specific training of a mechanical engineer. . . . The war has changed the outlook of the works manager. He has begun to realize that the man who has the advantage of wide reading and of thorough technical training, provided he has a natural practical bent, may make a far better under-manager than the man who has not these advantages, but has spent a much longer time in the workshop.

One reason which has militated against the more rapid absorption of the product of the technical schools as an integral part of workshop organization is to be found in the fact that too little time is given in the schools to teaching the art of production. The right use of tools and the accommodation of design to the methods of manufacture and to the tools available receive too little attention. Many lectures are devoted to the design and working of a dynamo or steam engine, but few to that of a lathe or milling machine. How often are parts of scientifically correct design incapable of being moulded economically in the foundry or tooled economically in the shop?

Our institution has an important part to play in this respect. Much can be done by encouraging the reading of papers which deal with workshop organization and with production from tools. There has been already a noticeable increase in papers of this character, and I hope it will continue. I do not agree that the discussion of these problems will tend towards advertisement, lower the general scientific status of the papers, or emphasize unduly the purely commercial aspect of works production. A description of the means adopted by a works manager to obtain maximum production of the required degree of accuracy at minimum cost is as important to the progress of mechanical engineering as the description of a new invention.

There is another side of engineering at which it is too often the custom of engineering institutions to look askance, namely, that concerned with the distribution and selling of the product. In most industrial engineering undertakings the commercial section of the staff is larger than the designing, testing, and foreman section, and it is just as essential to the highest success that it should be composed of trained engineers. A very large proportion of the men who enter engineering works with the intention of fulfilling their calling in constructive work find that they are drafted, through the force of circumstances, to the commercial side, and develop their careers in that direction. No salesman of high-class engineering products can be altogether successful unless he has the engineering instinct and has had a sound engineering training. The successful engineer-salesman must be able to understand and enter into the wants of the purchaser and suggest means for satisfying them. He must also understand thoroughly the properties and capabilities of what he has to sell. It is a common, though erroneous, idea that a man ceases to be an engineer when he becomes involved in the commercial side of engineering. On the contrary, it often happens that in discharging his commercial duties he is using to the best advantage his engineering knowledge and aptitude. . . .

Whatever may be the steps taken to widen the curricula for engineering students, it is essential that those occupied in administrative duties should recognize that successful administration is based on principles which are capable of definition and of scientific treatment and analysis, that the accumulated experience of others can be put into a form in which it can be taught and learned, and that those mental and moral characteristics which are essential in the good administrator can at least be developed, if not implanted by training.

We must not, however, be content with teaching only those who are to administer our works and factories. We shall never get the best out of any system of organization or administration in any field of work unless the workers themselves understand the principles upon which the system is based. A wise manager in an engineering shop will make no changes without first explaining their object to the workers, probably through the medium of the Works Committee. A still wiser manager will so develop the interest of the workers in efficient administration that proposals for improvement originate with them, and they thus assume the position of having to prove their case. With this in view, it is most important that there should be evening classes in administrative subjects in our technical schools.

Largely due to the experience gained during the war, the need for systematic instruction in industrial administration has been so prominently forced on the attention of those responsible for the conduct of some Lancashire engineering and other industries, that a year ago six firms combined to make an offer to the Manchester Municipal College of Technology to provide an annual sum for the establishment of a special department for this purpose. The department has been constituted and is worked in close co-operation with an Advisory Committee of those who are themselves engaged in works administration. A director has been appointed with three assistants. . . .

The material side is only one part of works administration; not less important is the purely human factor. All that pertains to the physical health and mental contentment of the workers is reflected in the efficiency of their work. The most important problems in the human side of administration are those connected with industrial fatigue. The efficiency of a man as measured by his capacity for output is dependent upon his hours of work, both in length and distribution, and the integration of the curves connecting rate of output with time of work will show the maximum amount of work which can be obtained from the individual. The investigation of these questions on a scientific basis is of a peculiarly difficult nature on account of the large number of independent variables which affect the result. But notwithstanding the difficulties which surround investigation, I

*Owing to the illness of the President, the address was read by Mr. Michael Longridge, immediate past-president.

am convinced that discussion of the deductions drawn from systematic observation by the physiologist and the psychologist, combined with the inductive conclusions of the works manager, will yield most valuable results. . . .

The right and economical use of the human labor working a tool has given rise to another line of investigation in workshop administration known as "time and motion" study. A "best" way can be found of performing any operation dependent upon muscular effort by methodical and scientific study of the various motions involved.

Though the actual application of such principles can only be carried out in the workshop and gauged by practice there, the importance of their study and the methods of studying them may well be taught at school or college. Our public schools take infinite pains to teach boys how to get the most out of a cricket bat or an oar with a given amount of muscular effort; coaching in rowing or cricket is acknowledged to be essential, why should not our young engineers have similar coaching in the multifarious manual operations of an engineering shop? The analogy of our organized school games also suggests that the interest of the worker may be enhanced and sustained if he is treated as a member of a team playing for a definite goal. "Team work"—that is, the combination of individual effort to achieve a definite result—ought to be developed to a much greater extent than hitherto in our workshops, and must increase efficiency and improve discipline.

Attention has recently been drawn to another psychological aspect of the labor question in engineering workshops where modern conditions are unfavorable to efficient work compared with those that obtained in earlier days. In the old days a millwright employed, for instance, in the setting out of a main gear for driving a mill, himself drew it out on the drawing floor, received the wheels from the foundry and set them out for tooling, and finally was usually selected to erect and set to work. From beginning to end of his job he had a clear idea of the ultimate use to which his work would be put, and was largely responsible for it until put into operation. Such incentives have necessarily disappeared under modern workshop conditions, but probably much may be done, even under the stifling conditions of modern repetition work, to impart to the workman a fuller knowledge of the ultimate object of his labor and so to engender a keener interest therein.

Production

Though the more far-sighted leaders of public opinion, both among employers and employed, now realize that only by increased production can we recover from the losses and damage of war, recent events too clearly prove that this truth has not yet permeated all classes of the nation. It has been thrust into the background by the demand for the establishment of a higher plane of living for the working classes without consideration of the means whereby it can be obtained. Every step in increasing consumption can only be achieved by increasing production in a much larger ratio. It is too often popularly assumed that the higher remuneration of labor will by itself secure an industrial Utopia, and that labor, if it has more to spend, will be able to satisfy its desires. Experience has shown that the very contrary is the fact. Mere increase in wages, mere changes in the distribution of wealth, have the effect in themselves, divorced from other influences, of providing less rather than more of the good things of the earth. It has been proved again and again from actual figures of most of our staple industries that a redistribution of the profits of industry, however desirable on other grounds, cannot in itself materially add to the welfare of labor unless it directly conduces to increased production.

If, as a nation, we are to realize what we all desire, a fuller and happier life for all classes of labor, every proposal for increase or change in the methods of remuneration of labor, every proposal for sharing or redistribution of profits, every proposal for change in control or in the management of industry ought to be subjected before adoption to crucial examination as to whether it will increase production per worker or can be accompanied by other changes in the conduct of the industry which will, in their combined effect, achieve the same object. Unless they satisfy this test we shall fail in attaining our end. Instead of promoting the welfare of the industry and of those engaged in it, we shall doom it to decay and ultimate extinction.

India

I have spoken hitherto solely of the home point of view with regard to reconstruction rather than of those wider considerations which apply to the Empire as a whole. In conclusion, I ask your attention for a few moments in connection with some matters which vitally concern us as engineers in one constituent part of that Empire—India, where the problems to be solved are not, as at home, those of reconstruction, but rather of construction.

Until a few years ago India looked almost entirely to Great Britain for the bulk of her engineering requirements, but we may expect that in the near future India will be in a position to rely less upon home engineering products, and will supply at least the simpler forms of these products from her own resources. I am not concerned now to inquire in detail whether this tendency will have a good or bad effect upon British engineering, but I may remark in passing that all industrial history shows that, although there may be hardships in certain industries in the process, the industrial development of one country, closely knit in its commercial relations with another, is to the ultimate benefit of both. . . . To promote the development of engineering industries in India is not generally in opposition to the best permanent interests of such industries at home, though it may entail temporary dislocation.

India has already laid the basis of an engineering industry in the establishment of two important and successful iron and steel works. The Bengal Iron and Steel Works under their present management have been established for some twenty-five years at Kulti, and have had a chequered career, during which, in 1903, an attempt was made to manufacture steel which proved unsuccessful, and was abandoned. The works are now most successful, both financially and in quality of product, turning out 10,000 tons of pig iron per month, about one-third of which is used in their own foundry for the manufacture of pipes, columns and pot sleepers and chairs. More recently the Tata Iron and Steel Works have been erected at Sakchi on the Bengal Nagpur Railway, about 155 miles from Calcutta, and in reasonably close proximity to their supply of coal and iron ore. The works were started in 1912, and have two large blast-furnaces in operation, each capable of producing about 350 tons of pig per day, a third nearing completion, and three more much larger in process of construction. Most of the pig is converted into steel. The rolling mills produce about 120,000 tons of rails and smaller sections yearly. About 13,000 men are employed in the works, adjacent to which a town having 50,000 inhabitants has sprung up, carefully planned in every detail with suitable houses, mostly provided with gardens, for all classes of employees, and schools, institutes, and hospital. These two works, even when extended, will not provide more than a fraction of the iron and steel India needs, of which the imports in 1913-14 amounted to over 1,250,000 tons.

At the present time India cannot roll a steel plate nor draw a steel tube; there are no rolling mills for tin-plate or for copper or brass sheets. Lead piping, galvanized sheets, steel wire, copper, and brass rods are not made in India, and no steel castings are produced except on a limited scale at some of the ordnance factories and in a few of the railway works. Even railway axles, carriage springs, wire ropes, and chains are imported. No steam engines of any size are constructed; probably the largest are those of some 400 h.p. for river craft. Portable engines, traction engines, and road rollers also are not made, nor steam boilers, except a few of very small capacity. Agricultural machinery, the greatest need of all in India, is not manufactured except to a limited extent in its simpler forms. Substantially no cotton or jute machinery, either for spinning or weaving, is made in the country. Locomotives cannot be built without obtaining many essentials from abroad, and shipbuilding is in its most elementary stage. Electrical machinery

of every kind is imported. Apart from the railway workshops, the principal centre of general engineering workshops in India is Calcutta, but in 1915 there were only twenty-seven of these with an aggregate of 12,000 employees.

Owing to the pressure of war conditions, the situation in respect of engineering industries is rapidly changing. The Tata Iron and Steel Company will shortly have a large plate mill at work for rolling plates up to $1\frac{1}{4}$ in. thick and it is proposed to construct a wire mill and a belt and nut shop of large capacity. Works are to be erected for the manufacture of tea machinery, which hitherto has been entirely imported. Schemes are in hand for the manufacture of agricultural implements in India from Indian steel. Vacuum brake material, as required by the Indian railways, is now being made in India. Galvanizing is being carried on on a fairly large scale by several companies. A large workshop has been erected for the manufacture of jute mill machinery of all classes, now entirely imported into India. Such are only a few of many instances of advance. . . .

There is as yet no base on which to build elementary mechanical training for the Indian artisan. With a people almost wholly illiterate, schools for the teaching of elementary mechanical subjects are useless for the ordinary boy, and in those that have been started it is soon found that the first years must be spent in imparting sufficient elementary education to enable the scholar to derive any advantage at all from vocational teaching. We must look to the workshop itself, not only for training in the particular crafts, but also for such general elementary education and rudimentary technical education as are necessary for the acquisition of craftsmanship. Although a man may become exquisitely skilled in the art of, say, carving ivory, or engraving brass, and remain entirely illiterate, depending upon hereditary genius in his craft, he cannot become a patternmaker or fitter unless he can read and understand a drawing. Wherever schools in direct connection with workshops have been set up, the results have been most satisfactory. If a class of artisan mechanics is to be built up in India, every engineering works, either alone, if of sufficient size, or otherwise grouped with neighboring works, should provide a school for teaching the boys employed both general subjects and also such elementary technology as is suited to the trade they are learning, and the teachers as far as possible should be drawn from the foremen and others engaged in the works.

These engineering developments in India must have a marked effect on the professional status of engineers employed in India which it is incumbent on us as members of the institution to watch closely, and, where possible, to influence for the benefit of our own members in India and for the maintenance of high professional standards.

At the present time there are in India about 600 members of the Institution of Civil Engineers, 400 members of the Institution of Mechanical Engineers, and about the same number of members of the Institution of Electrical Engineers, besides members of various other bodies, such as the Institution of Naval Architects, the Iron and Steel Institute, and various mining societies. There are also undoubtedly many qualified engineers in India holding positions of responsibility who are not members of a home society. But India is a vast country, and these engineers are split up into little groups working in places separated by great distances and only aggregated to any extent in such industrial centres as Calcutta and Bombay.

The Indian Industrial Commission gave much attention to the various suggestions made to them by engineers in various parts of the country on this subject, and in its report advocated the foundation of a representative Society of Indian Engineers. It is obvious that conditions in India preclude the formation of individual institutions to represent the various branches of engineering, and that the objects of such a society could only be attained by combining all branches of engineering, whether civil, mechanical, electrical, mining, or R.E. The recommendations of the Commission have been actively taken up by engineers of all classes, and I am glad to say especially by our own members in India. The institution of such a society was decided on at a representative meeting held in Calcutta in December last under the presidency of Sir Thomas Holland. A committee was appointed to draft proposals for the constitution of the society and rules for its conduct and to consult all the various interests involved. I am informed that all the existing organizations have decided to cooperate in the formation of the new society, so that it will embrace and be representative of all professional engineering interests in India. It was at one time thought possible for the new society to be formed under the auspices of our leading home institutions, but for various reasons such a plan was not feasible, and I think it is generally conceded both here and in India that it is better that the Indian Society, knowing the wants of its own members and the local conditions, should devise its own constitution independently. At the same time, it is, I think, incumbent upon our institution to use its influence in maintaining a high qualification for membership in the Indian Society and to collaborate with it with a view to obtaining the benefits for our own members in India which such a society can provide.

SYNTHETIC CAST IRON

C. A. Keller, the French metallurgist and electric furnace expert, discusses and describes at considerable length the process which he elaborated before and during the war for the manufacture of synthetic cast-iron from steel turnings, etc.

Briefly, the process consists in melting the turnings in a specially arranged electric furnace, which he describes. There are two possible methods of producing the cast-iron: the carburizing medium can either be added to the steel in the molten state, or, as in the writer's process, the carbon is incorporated in the charge in the form of fine coke or charcoal, so that the process of carburization is continuous and gradual. The basic slag as added to the burden ensures desulphurization of the charge, if this is required, and at the same time diminishes the conductivity of the mass by the interposition of non-conducting materials with the conducting materials (turnings and carbon), thus enabling the process to be carried out at the tensions usually adopted in electro-thermal operations. Thus the cast-iron obtained in the presence of a sufficiently basic slag retaining the small quantity of silica introduced, contains practically all the material composing the burden, excepting the sulphur, without increase of silicon, and the carbon of the charge is used only for carburization, and has no appreciable effect on the silica.

As an example of what may be achieved by the method, from steel turnings containing:

Si	0.44 per cent.
Mn	0.55 per cent.
S	0.07 per cent.

a white cast-iron giving the following analysis has been obtained:

C	3.55 per cent.
Si	0.52 per cent.
Mn	0.48 per cent.
S	Trace.

The mechanical properties of cast-iron obtained by the writer's process have been very satisfactory.

As regards the economy of the process, the writer states that the consumption of electrodes may be reduced to 6 kg. per ton, provided they are of good quality. The consumption of non-oxidized steel turnings is 1,050 kg. per ton of cast-iron, this figure increasing to 1,100 kg. with fairly oxidized turnings. The quantity of coke containing 80 per cent. of fixed carbon required for obtaining a ton of extra-high strength cast-iron containing 3 per cent. carbon and 1.75 per cent. silicon, using ordinary steel and shell-turnings, is about 80 kg.

Several new plants were laid down by the writer's firm during the war and they attained a very high degree of organization, supplying cast-iron to outside firms also. The detailed arrangements of this lay-out and of the patented furnaces used are given in the original article.

The future of the synthetic method of manufacturing cast-iron will depend of course mainly on the quantity of raw material available, as well as on the possible extensive application of hydro-electric energy for the purpose.—Bulletin de la Societe de l'Industrie Minerale.

The Use of Abrasive Wheels for Metal Cutting

Abrasive Wheels Are Now Recognized as an Ideal Medium for Removing Metal in Quick Order. Some Practical Hints Are Given Herein on Selection and Proper Mounting of Wheels, Etc.

By EDWIN L. MONK

THE use of abrasive wheels for the purpose of cutting and shaping metal and other hard substances has of late years gained favor to a remarkable extent, both with large and small engineering shops. The reason for this development is not difficult to discover when we consider that rapid production and economy in labor are two factors which are of the utmost importance to the success of any business undertaking.

The following table shows the relative percentage weights of cast iron, wrought iron, steel, and brass removed by ordinary hand processes as compared with that removed by a grinding wheel in the same period of time:

	Emery wheel.	Hammer and chisel	File	Wastage of emery wheel.
Cast iron	100	30	4.6	9
Wrought iron	100	26.2	6.9	34
Steel	100	2.7	1.8	53
Brass	100	7.5	3	24

A good grinding wheel should cut freely and not glaze or fill up with particles of the material it is cutting. The work when grinding operations are complete should be smooth.

The Proper Wheel

The actual selection of a wheel for any particular class of work can generally be left to the manufacturer. When sending an inquiry a piece of the material it is desired to grind, and also, if possible, a sample piece which has been actually ground will be of great assistance in enabling the suppliers to select the most suitable grade of wheel for the work required. The inquiry should also state the diameter and width of the wheel. If the shape is irregular, but is a standard manufacture and can be found in the manufacturer's catalogue, then the list number will be sufficient; if not a standard, then a rough dimensioned sketch should be supplied. The exact diameter of the arbor on which it is proposed to mount the wheel must also be given, and the hole in the wheel should allow a comfortable sliding fit. The correct clearance allowance can be left to the manufacturer.

If it is found impossible to send samples as suggested, then a description of the kind of material to be ground, stating whether rough or finished work is required, should be included in the inquiry, and in any case whether samples are sent or not it should be stated whether the work is to be applied by hand or automatically, and whether it is proposed to use the side or the periphery of the wheel, also some idea as to the kind of surface, whether flat, irregular, or cornered, should be given.

Users who wish to make their own choice of grade may be guided by the following considerations: The coarser the grit and the softer the grade, the more rapid will be the cutting effect. On the other hand, by using a fine grit and a hard grade the total amount of work performed by a wheel is increased, whereas for high finish a fine grit and soft grade is necessary. Heavy work calls for a harder wheel than light work. A harder wheel must be used for corners and edges than for surface work. The wheel must be softer as the contact surface increases.

Three materials are chiefly used in the manufacture of grinding wheels, emery, corundum, and carborundum, Emery is a mixture of corundum and hematite, and contains impurities to the extent of about 40 per cent., which are, of course, useless as cutting agents and cause undue heat.

Corundum is far superior to emery as its impurities only amount to about 4 per cent. of its composition, giving a cutting efficiency of anything from 30 to 100 per cent.

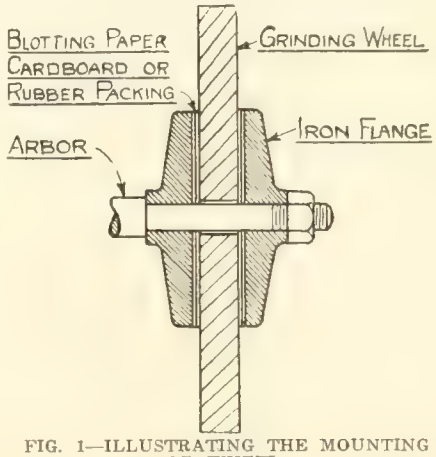


FIG. 1—ILLUSTRATING THE MOUNTING OF WHEEL.

Carborundum is composed of 30 parts by weight of carbon to 70 parts of silicon, and will easily cut either corundum or emery. Carborundum is an artificial abrasive, and is produced by means of an electric furnace. It is very brittle and practically infusible.

Grinding wheels are manufactured in various degrees of hardness to suit the particular class of work for which they may be required. The varying degrees from soft to hard are usually denoted by letters of the alphabet, and are known as grades. The grade of wheels is obtained by varying the amount of bond. If an increased amount of bond is used the particles of the wheel are not so easily broken, and it is consequently graded as hard; if, on the other hand, less bond is used, the grade will then be soft. The actual size of the abrasive grains are sorted out and are numbered after they have been passed through sieves, each having a varying number of meshes per square inch. For the ordinary purposes of manufacture the grades range from about 8 to 100; for special purposes, however, finer grades can be procured.

Proper Mounting of Wheels

We now come to the question of mounting the wheels on the machine, and this is a matter over which great care should be exercised. Flanges should be used to support the wheel on each side, and in the case of large wheels the size of the flange should be from one-half to two-thirds the diameter of the wheel. As the wheel gradually wears down the flanges should be replaced by a pair of smaller diameter. Rubber, cardboard, or blotting paper washers must be used between the flange and the wheel, and care should be taken to ensure that the wheel is not a tight fit on the arbor; there should always be a slight clearance to allow for expansion of the arbor, which may become heated when running and so cause the wheel to burst. The flanges must not be tightened up too much, not more than is necessary to prevent the wheel from slipping on the arbor. Fig. 1 shows the correct method of mounting a grinding wheel.

Sometimes a new wheel may get cracked in transit and the defect may be quite invisible, so that it is always advisable to ascertain that it contains no flaw. If a perfect wheel is gently tapped with a small hammer, it will produce a clear ring, whereas if it contains a flaw, then the sound it emits will be dull and dead. Wheels which are found to be defective should not under any circumstances be mounted.

For wheels of average thickness the following size arbors will be found to be amply strong enough: ½ in. diameter arbor for wheels 6 in. diameter or less; ⅝ in. for 8 in. diameter; ¾ in. for 10 in. diameter; 1 in. for 12 in. diameter; 1¼ in. for 14 in. diameter; 1½ in. for 16 in. diameter; 1¾ in. for 18 in. to 20 in. diameter; 2 in. for 22 in. to 24 in. diameter; 2¼ in. for 24 in. to 26 in. diameter; 2½ in. to 3 in. for wheels 26 in. diameter and over.

If the wheels are extra thick, then the sizes of the arbors should be increased in proportion.

The correct peripheral speed of grinding wheels in order to obtain the best results for ordinary purposes may be taken as from 5,000 to 5,500 ft. per min. Sometimes on large wheels 6,000 ft. per minute may be reached. A good practical method of obtaining the correct speed is to first run the wheel at a high speed and then gradually reduce it until the

*From "Practical Engineer."

wheel just begins to crumble; the most efficient speed will be slightly above "crumble speed." When the correct peripheral speed has been ascertained for any particular wheel, it should be maintained at that speed in order to obtain equal efficiency. This, of course, means that as the wheel wears down the revolutions per minute at which the machine is running must be increased. This may most conveniently be done by means of some variable-speed device, of which there are several on the market, or by means of cone pulleys. A less satisfactory way is to change the driving pulleys. The objection to this, of course, is that the speed variations can only be obtained in steps, intermediate speeds being impossible.

Operators often complain that wheels appear to be softer towards the centre, the real cause of the trouble being that the speed has not been varied in proportion to the wear of the wheel.

On no account should a wheel be run at a greater speed than that recommended by the manufacturer. The great danger and risk in doing so lies in the fact that the stress due to centrifugal force does not vary in direct proportion to the speed of the wheel, but as the square of its velocity; which means that if the speed is doubled, the stress due to centrifugal force will be increased four times. For instance, a wheel travelling a peripheral speed of 5,000 ft. per minute sets up a stress of about 75 pounds per square inch. At the factory wheels are usually subjected to a test of 9,000 ft. per minute peripheral speed, the test being carried out under special conditions, proper protection being afforded against breakages; at this speed the strain due to centrifugal force is about 250 pounds per square inch.

In order to ascertain the necessary revolutions per minute of any particular-sized wheel to produce any desired peripheral speed the following formula will be found useful:

$$\text{R.P.M.} = \frac{\text{Peripheral speed in feet per min.} \times 12}{\text{Diameter of wheel in inches} \times 3.1416}$$

In order to make this quite clear, we will take a specific example and assume the wheel to be 26 in. in diameter, and that we wish to obtain a peripheral speed of, say, 5,500 ft. per minute. Applying our formula, we get

$$\text{R.P.M.} = \frac{5500 \times 12}{26 \times 3.1416} = 806$$

The table following will be found useful.

Wheels of cup shape should not be run faster than 3,000 to 4,000 peripheral feet per minute unless they are specially supported, but ring wheels carried in chucks can be run at ordinary speeds. The use of water on grinding wheels limits their speeds to about 3,500 peripheral feet per minute, as above this speed it will be found impossible to keep the water on the revolving surface. Wet grinding is used to-day to a far greater extent than might have been expected, judging by the prejudice that existed some few years ago. Up-to-date machines and improved water arrangements have to a great extent been responsible for the development which has taken place in this class of work.

It is most important that grinding wheels should be kept perfectly true, not only on account of better working efficiency, but also to ensure safety in working. Trueing up wheels is done by means of a wheel dresser or a diamond. A wheel dresser consists of a series of toothed wheels the teeth of which are sharpened to a knife edge. These wheels which are made out of hardened steel, are mounted side by side on an arbor, which is carried on a fork provided with a handle. This tool is held firmly at such a distance from the edge of the revolving wheel, so that any prominent parts may first be removed; when this is accomplished, the dresser can be brought gradually closer until the wheel is turned perfectly true.

Diamond dressers consist of a steel bar, which is sometimes provided with a handle, the cutting diamond being mounted at the other end of the steel. The diamond tool is used in exactly the same way as the wheel dresser. When dressing a wheel it is not absolutely necessary to alter the speed, but when using a wheel dresser it is certainly advisable to reduce the speed to about half normal working speed, and the use of water will prevent heating of the cutters and dust.

Certain grade wheels are specially made for individual classes of work, and

Dia. of wheel in	R.P.M. for surface speed of			
inches	4000 ft.	5000 ft.	6000 ft.	7000 ft.
1	15,279	19,099	21,009	22,918
1.5	10,186	12,732	14,005	15,278
2	7,639	9,549	10,504	11,459
2.5	6,112	7,640	8,404	9,168
3	5,093	6,366	7,003	7,639
3.5	4,366	5,456	6,002	6,548
4	3,820	4,775	5,253	5,730
4.5	3,396	4,244	4,668	5,092
5	3,056	3,820	4,202	4,584
6	2,546	3,183	3,502	3,820
7	2,183	2,728	3,001	3,274
8	1,910	2,387	2,626	2,865
9	1,698	2,122	2,334	2,546
10	1,528	1,910	2,101	2,292
12	1,273	1,592	1,751	1,910
14	1,091	1,364	1,500	1,637
16	955	1,194	1,313	1,432
18	849	1,061	1,167	1,273
20	764	955	1,051	1,146
22	694	868	955	1,042
24	637	796	876	955
26	586	733	806	879
28	546	683	751	819
30	509	637	701	764
32	477	596	651	716
34	449	561	618	674
36	424	531	584	637
38	402	503	553	603
40	382	478	526	573
42	364	455	500	546
44	347	434	478	521
46	332	415	457	498
48	318	397	437	477
50	306	383	421	459
52	294	369	405	441
54	283	354	290	425
56	273	341	376	410
58	264	330	363	396
60	255	319	351	383

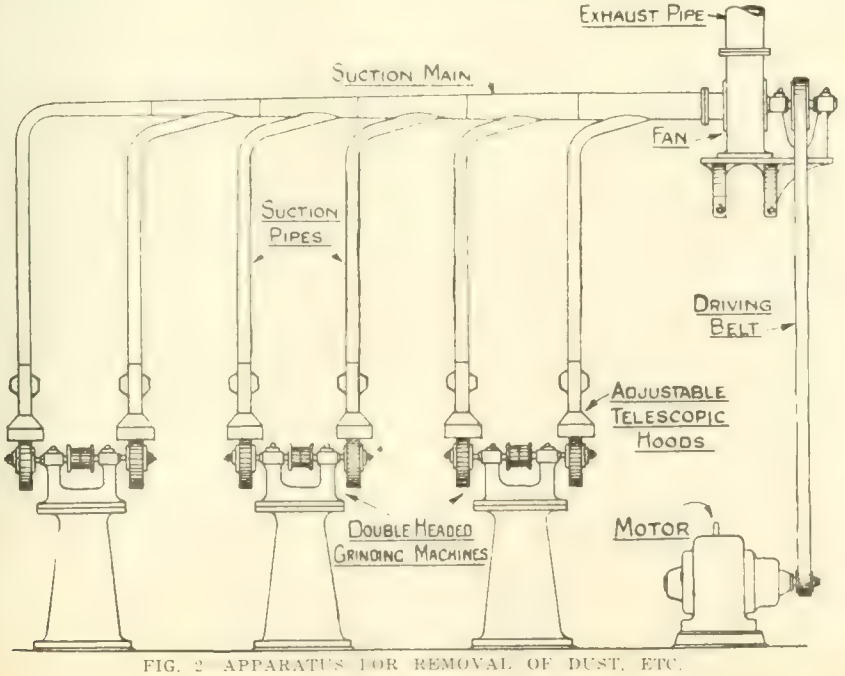


FIG. 2 APPARATUS FOR REMOVAL OF DUST, ETC.

if a wheel should fail to give satisfaction it will often be found that the cause is not the wheel, but that the purpose for which it is being used is not that for which it was supplied; or, again, the speed may be wrong. The best results cannot, of course, be obtained under such conditions, which more often cause glazing of the wheels and heating of the work. Grease and oil should be carefully kept away from wheels. Heavy machines mounted on a solid foundation are very desirable in order to eliminate vibration as much as possible. The rests should be properly adjusted so as to prevent any chance of the work getting wedged between the rest and the wheel.

In modern works, where several machines are kept more or less continuously employed, it is very desirable that proper provision should be made for the removal of the dust, which in most cases is very detrimental to the health of the operators of the machines and to those employed in the shop. There are several firms of ventilating and heating engineers who specialize in this particular branch of work and who are usually

glad to submit plans and quote for schemes to suit individual conditions. Fig. 2 shows a typical plant arranged for extracting the dust from three double-headed grinding machines. Dust-extracting plants of this description usually consist of a paddle-type fan with the bearings properly protected from dust. A main suction pipe is connected to the fan, and smaller branch pipes connect the machines to the main suction. Hoods are placed over the grinding wheels and are fixed to the ends of the branch suction pipes by means of telescopic tubes; this arrangement enables the operator to adjust the hoods close to the wheels when small articles are being dealt with, or to slide them up to admit larger articles. The pipes are usually made of sheet steel riveted and galvanized.

Accidents can in many cases be prevented by proper care. Some of the causes we have already mentioned, such as forcing wheels on to arbors which expand on account of heat and burst the wheel; other causes are allowing work to become jammed between the rest and the wheel; running wheels on unstable machines; either omitting to use flanges or using those of wrong or too light design; loose bearings; applying too much pressure to the emery dresser.

The following precautions should be observed by those responsible for the working of grinding wheels: The rests should be of substantial design, and should be used in such a position relatively to the wheel that it is impossible to get any work jammed between them. It is better policy to run each machine at one fixed speed, and this speed should be painted either on a board fixed near the machine or on the machine itself; as the wheel wears down it should be transferred to another machine making more revolutions per minute, so that the peripheral speed may be maintained. Where practicable this plan is preferable to the use of cone pulleys from the standpoint of safety, as it eliminates the danger of too high a speed being used by the uninitiated operator without the knowledge of the foreman in charge; although, on the other hand, considered from the practical working standpoint, it must be admitted that the cone pulley is certainly more convenient where only a few machines are used. Wheels should be kept true and in balance, and the dressing tools should be in charge of some responsible person. Machines should be enclosed as far as possible by sheet steel guards.

The Vertical or Horizontal Compressor?

By A. W. SWAN

IT is a curious fact that the trend of air compressor as distinct from low pressure blowing engine's design, has followed entirely different lines in North America and in Great Britain. With the exception of small air compressors for garage work, etc., and one special horizontal and vertical machine, American manufacturers have held to the horizontal design, while the trend in Great Britain is entirely in the opposite direction, and the horizontal compressor is unusual.

The reason behind this difference in design is largely a matter of tradition. England and Scotland have been for years the greatest shipbuilders in the world, and the marine engine has been developed largely by British engineers. The marine triple-expansion engine is invariably vertical. It was natural to keep to this construction for stationary steam engines for power houses, etc., and when the first air compressor cam to be built, steam driven, the line of least resistance was followed, and the air compressor was also built with the vertical construction, having the steam and air cylinders in tandem. On this continent the air compressor was developed independently from the steam engine, and while the advantage of the vertical construction were admitted, the horizontal compressor was seen to have its own advantages, and this style was held to. In a large part of Canada and the United States coal is both dear and difficult to procure, and the consequence has been the rapid development of Hydro-Electric power, and the decrease of direct use of steam power except in certain favored regions. One consequence of this has been the rapid development of the electric drive for air compressors, and a still greater separation from the old steam engine traditions. In Great Britain, on the other hand, while coal has risen greatly in price, it is always available—except during strikes—and while electric power supplied from central stations is making great strides, direct steam power is still used very largely. As a result of this, the steam-driven air compressor is still important and as a matter of fact, in the catalogues of some of the British compressor manufacturers the claims of the steam drive are urged quite strongly.

The principal advantage of the vertical type of construction is compactness; no horizontal compressor however arranged, can hope to compete with the vertical machine for minimum space. This feature is important chiefly where space is at a premium, as where a compressor has to be tucked away into a corner of an existing engine room. Another advantage urged for the vertical type of compressor, or at least, one that is put forward by the British manufacturers, is that with the horizontal construction the weight of the piston causes it and the rod to wear oval, with consequent loss of efficiency.

However, extreme compactness is not always the controlling factor in a compressor installation, particularly if the compactness carries with it some disadvantages, and if the vertical construction has such manifold advantages it is surprising that the Ingersoll-Rand, Chicago Pneumatic, Sullivan (except in their twin-angle machine) have held so tenaciously to the horizontal type of construction. The fact is, that horizontal construction of air compressors carries with it the great advantage of accessibility, which is often at least as important as extreme compactness. A well-built compressor will run steadily for months without even inspection, but even the best of machines is none the worse for an occasional run over, and if a compressor is built so that inspection is easy it is much more likely to have attention than one which is difficult of access. Even with the best systems of splash or forced lubrication, including strainers, etc., the oil should be cleaned out every now and again and sent to the filter; in fact, accessibility is a highly important and necessary feature in an air compressor. And the horizontal machine is certainly easy of access for inspection. The crank chamber can be inspected by lifting off a cover in some makes, cross-head and guides are similarly get-at-able. The cylinder is also easily accessible without having to climb a ladder to get at the cylinder head, and this applies particularly to the steam-driven compressor. Then as to the piston wearing oval, there seems to be another case where the theory sounds better than the actual facts; at least there are hundreds of large and heavy air compressors all over Canada and the United States, all of horizontal construction, and it certainly is not a common complaint to hear of pistons and rods wearing oval, and giving trouble in this way.

When all other considerations have been weighed, there remains one important advantage of the direct-connected horizontal air compressor—fewer bearings. The rotor of the motor for the direct-driven horizontal type of compressor is wound on the main driving shaft, and there are only two bearings. In the vertical machine the motor is at one end of the compressor, with the fly-wheel between compressor and motor. The motor has its own two bearings, there is another bearing between fly-wheel and compressor, and two more bearings in the compressor itself. The

whole unit is mounted on one base, and as the four [illegible] are made in the setting, there will be no difficulty about securing correct alignment for the initial set-up. But maintaining correct alignment when the bearings begin to wear is another story. So that while the vertical direct-connected machine is satisfactory if properly erected, and if the foundation is absolutely stable, the direct-connected horizontal machine is easier to erect, and keep in alignment.

Summing up, it is seen that the vertical type of air compressor has certain advantages, such as compactness and evenness of wear of piston and piston-rod—these advantages being more apparent in the steam-driven machines, while the horizontal compressor scores for accessibility, and, in the direct-connected type, simplicity of erection.

EFFICIENT FOUR LEVER JIG

By HUGH SCOTT

It is not often that one jig can be made for four different levers, but the following one described accomplishes this fact very easily. The jig is by no means intricate in design, which is of course a point in its favor. Readers will do well to study this design as it is a sure money saver.

First let us refer to Figs. 1 to 4. Here we see the four levers, and, as can be noticed, the lengths from centre to centre are different, also the widths and diameters of the hubs. The holes and shapes are also entirely different for each one of these levers so it was necessary that we design a jig that would incur no loss of time in changing over.

The operation to be performed of course was drilling. Every lever had to be drilled correctly without bothering to remove the jig from the drill press.

The large holes were drilled in the centres of these hubs, therefore this left only the question of designing a jig adjustable in such a way as to insure absolute correctness in the length from centre to centre, after the small holes were drilled. The result is shown at Fig. 5.

First look at the plan view. Note the line AB through which the section view shown below was taken.

The jig proper consists of the following members: A cast iron body rested on two legs as illustrated, and connected by two tie rods F. The top plate of the jig is finished and provided with the slot J. Another cast iron side G is fitted to this top plate in such a manner as to slide in the slot J already spoken of. This slide G can be fastened at any spot within the limits of the slot J by means of the stud and washer with the nut H. The upper shaft, or shank I, is turned to suit the hole of one of the levers.

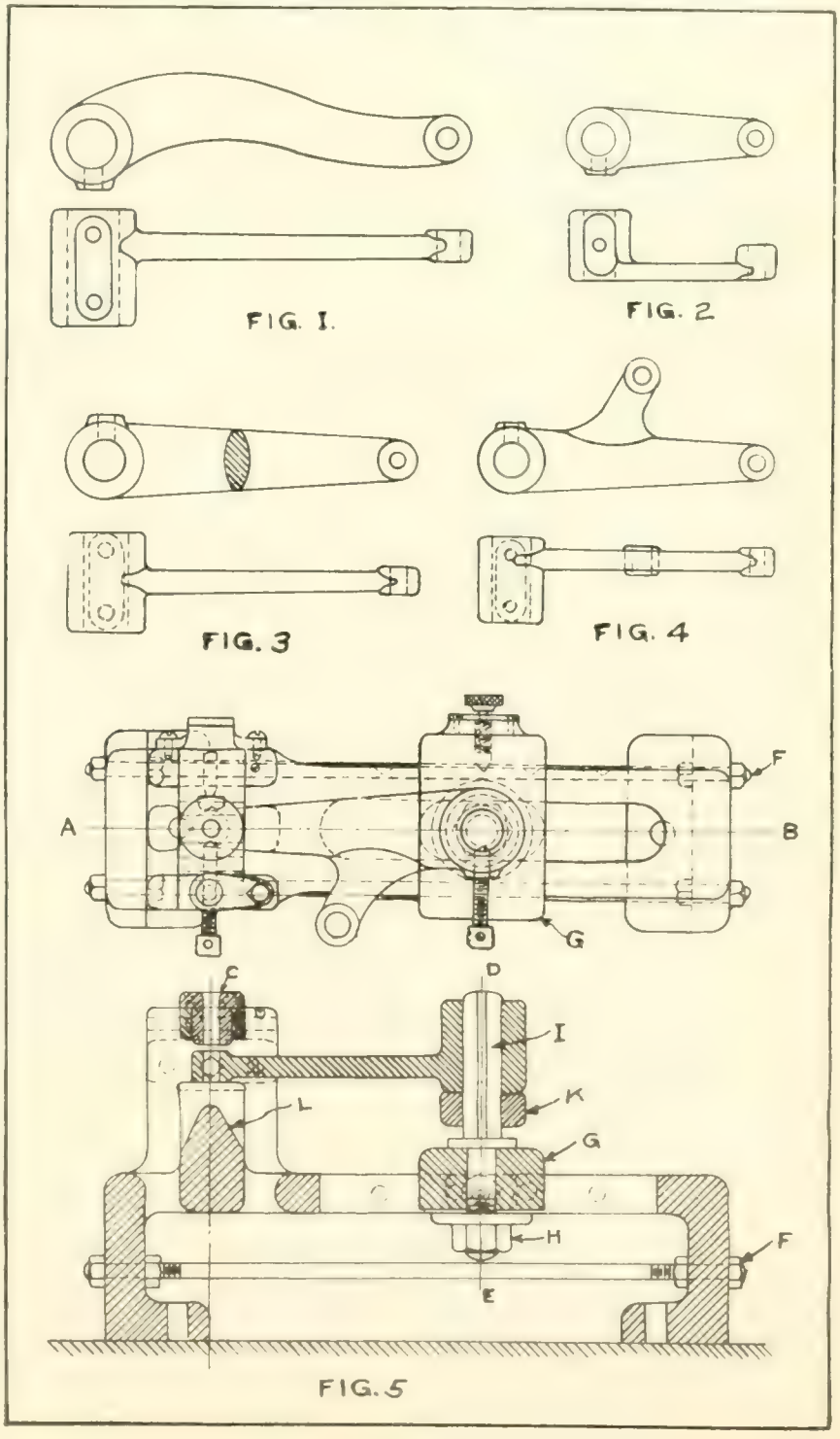
The collar K is adjusted by a screw to hold the holes of the various levers at their correct height. This stud I already mentioned is provided with a groove which receives the hardened point of a screw which in turn prevents the collar from moving around. One side of the slide G is provided with a hub. This hub is drilled out to receive a pin. This pin is always pressed against the sides of the body by means of a spring. A knurled head serves to draw this pin back.

A projector is cast on the body and worked out to receive a steel hinge. This hinge is held by a small steel lever with a handle while the jig is in operation.

This jig is [illegible] cleaning, since the chips all fall over; V-shaped rib L as shown

This illustration shows one of the levers actually in the jig. If it is to be used for another size and shape of lever, the stud I is taken out and replaced by one which fits the lever to be drilled. The pin already spoken of is now drawn out and the slide G moved to its correct position and fastened to the nut H.

The jig is now ready for work, so we leave readers at this point to study it out for themselves.

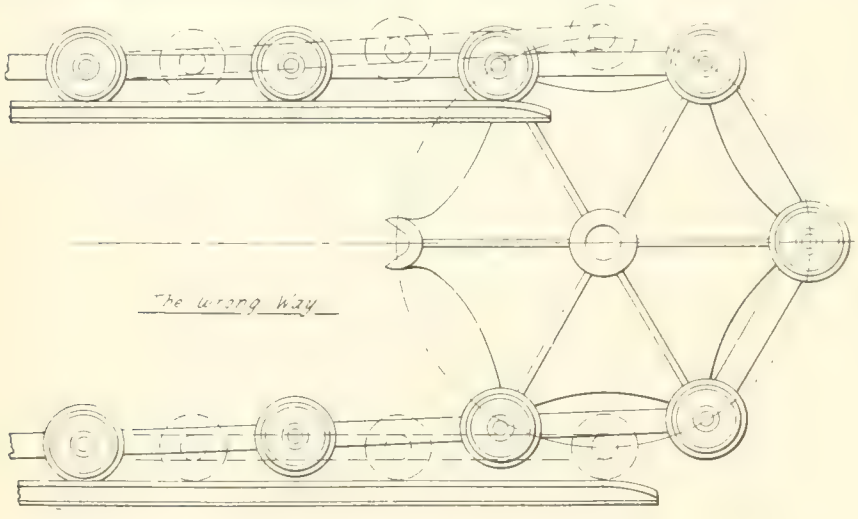


WHAT OUR READERS THINK AND DO

LOCATION OF RAILS IN BUCKET CONVEYORS

By John S. Watts

It is a peculiar fact, but all the bucket conveyors the writer has ever seen are built with the rails placed as shown in Fig. 1. That is, with the upper and lower rails in line with the tread of the wheel, when the wheel is at low point of the vertical movement, due to the revolution of the sprocket.



It must be admitted that to anyone without experience in operating these conveyors, the position of the rails shown in Fig. 1 would appear to be the correct one, but it is not, as will be shown in what follows:

In the sketch, Fig. 1, is indicated by dotted lines, the wheels in the position they will occupy when the sprocket has revolved 30° from where it is shown in full lines.

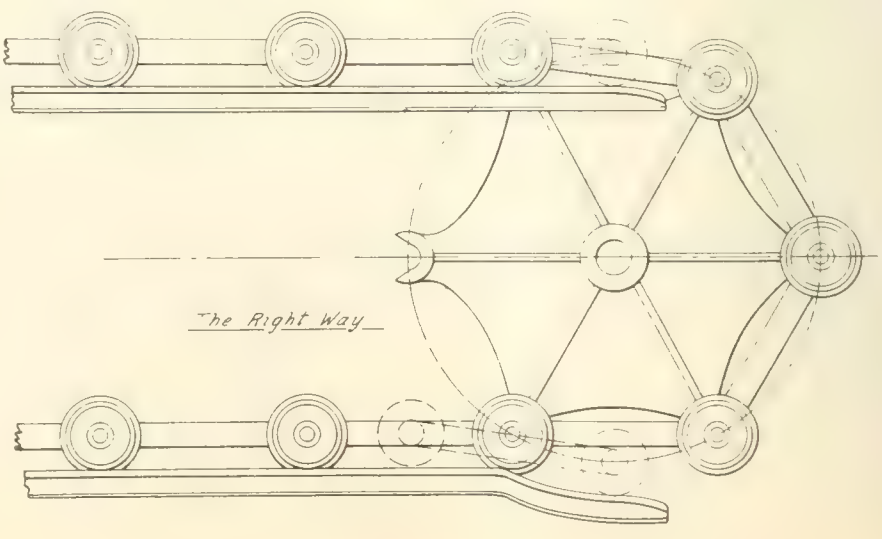
Taking the upper rail first, we find that the wheels and buckets have been raised from the rails, and of course will fall back on the rail when the sprocket revolves through another 30°.

On the bottom rail the same raising and falling of the wheels and buckets takes place, as is shown by the full and dotted lines.

With the large buckets now in use weighing as much as 3,500 pounds when loaded, the rising and falling causes a constant hammering of the wheels on the rails, accompanied by a deafening noise and destructive vibration in the whole structure. I have seen this effect so severe as to break the wheels.

The remedy for this hammering is to raise the rails up to the position shown in Fig. 2; this, as a perusal of drawing will show, prevents the wheels from ever rising from the rails and there cannot, therefore, be any hammering.

This change in the location of the rails can be made in conveyors already built by blocking up the rails to the required amount at the sprockets. The track may not be raised throughout the whole length of the conveyor as it will answer our purpose just as well if we start at that point at which the wheels commence to leave the rail. At this point the rail should commence to rise on a gradient such as to bring it up to the height shown at the sprocket, in Fig. 2.



PORTABLE LIGHTING FOR MACHINES

No matter how well-lighted a machine shop may be from a general effect point of view, the portable form of local illumination is always a necessity. The overhead fixed lamp, whether gas or electricity be the medium employed, may be quite adequate for setting up a job in a machine or for subsequent plain, straightforward operations, but when it comes to precision work of a fine character, intricate operations, and a close attention to scribed lines, pop marks, or in measurement checking in thousandths, then the shadows created by interposing solid objects, and the lack of concentrated light, local rather than general, makes accuracy and working comfort a difficult proposition. It is a debatable point whether gas or electricity makes the best form of portable light; personally I am inclined to the former.

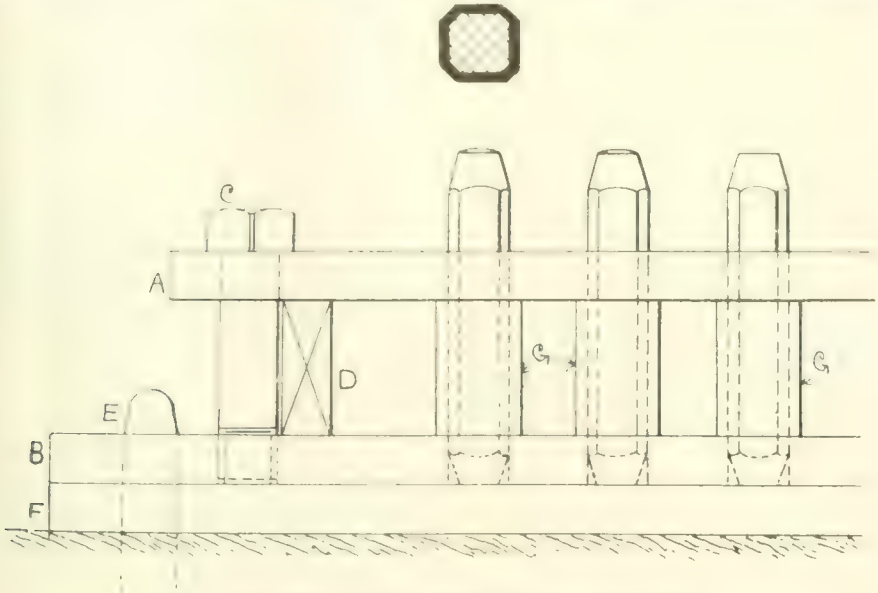
A convenient type for general machine operations is that which consists of just a short vertical length of, say, ¼ in. iron tube, furnished with an ordinary burner and a tap; the base being a fairly heavy block of lead, having a broad, flat bottom so that it shall not easily topple over. And it is always the better plan to use flexible metallic tubing rather than plain rubber. Often, too, it is desired to show a light some way down a deep hole that is being bored out or recessed, either in lathe or vertical boring mill. It will be found that an excellent portable lamp can be made by utilizing a length of ¼ in. iron tub-

ing welder at the end and having drilled up the centre a 1-32 in. diameter hole.

PREVENTING STAMPS FROM RISING

By F. Horner

During the period of hostilities an urgent job of figure stamping came in, consisting of markings for depth in fathoms, on a ⅜-in. steel plate about a foot long. To locate the correct position of the stamps, a frame was built up as seen in the illustration (showing one end), comprising guide-plates, A and B, fastened together with a pair of set-screws, C, packing, D, being laid in as distance-pieces. The frame was located by dowell pegs, E, passing through the plate, F, to be marked, the pegs being driven into a baulk of timber acting as a cushion. The plate was therefore dropped over the pegs, the frame lowered over, and the stamps struck in rapid succession. The trouble was to keep these in position without bouncing up after the blow, and a simple solution of the difficulty was found in the shape of bits of rubber tubing, G, cut to length, and through which the stamps were forced.



HOW THE STAMPS WERE PREVENTED FROM RISING.

THE WELDER IN LOCOMOTIVE REPAIRS

The importance of having competent welders, particularly in the repair of locomotive boilers, was again emphasized at the recent convention of the Master Boiler Makers' Association. The boiler being, so to speak, the heart of the locomotive, any laxity in its construction or inspection is usually followed by disastrous results. One vital feature of boiler making and repairing is the practice now becoming quite extensive, of welding patches to the sheets when repairing cracked or otherwise defective parts of the boiler. There is no other form of repair work that may be so easily slighted through incompetent or careless workmanship and still pass the required inspection, only to fail at some critical moment in the operation of the locomotive. Many excellent papers are published from time to time in the technical journals devoted to railroad questions, and it is the duty of the men who have taken up welding to keep themselves fully informed concerning the methods and progress of the art of welding. Both the electric and the acetylene gas welding apparatus have been developed to a point where they require only careful and intelligent operation to secure satisfactory results. Anyone taking up this line of work may be assured of every assistance from the manufacturers of the welding outfits, as well as from their shop foremen, and should not fail to take advantage of every channel of information available. The importance of careful welding in every repair made to a locomotive boiler cannot be too strongly impressed on those who are engaged in this work.—"Railway Mechanical Engineer."

TAPERS.

A machine piece is said to be tapered when no two places of its diameter are equal. Tapers are usually specified as the difference in their end diameters in inches, of a piece one foot in length, as, taper per foot.

$$\text{Taper per inch} = \frac{\text{Large Dia} - \text{Small Dia}}{\text{Length}}$$

$$\text{Taper per foot} = \frac{\text{Large Dia} - \text{Small Dia}}{\text{Length}} \times 12.$$

$$\text{Large Dia} = \text{Small Dia} + (\text{Taper per inch} \times \text{Length})$$

$$\text{Small Dia} = \text{Large Dia} - (\text{Taper per inch} \times \text{Length})$$

$$\text{Length} = \frac{\text{Large Dia} - \text{Small Dia}}{\text{Taper per inch}}$$

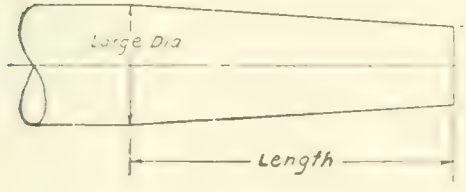
When the taper is excessive, its value is given in degrees.

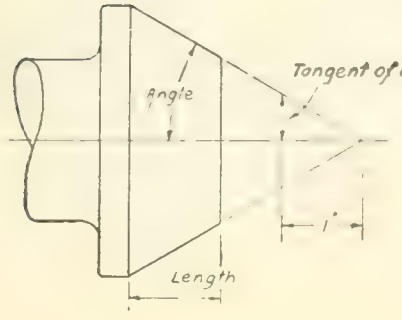
$$2 \times \text{Tangent of angle} = \text{Taper per inch}$$

$$\text{Taper per foot} = \text{Tangent of angle} \times 24.$$

$$\text{Difference between both Dia's} = \text{Tangent of angle} \times \text{Length} \times 2.$$

$$\text{Length} = \frac{\text{Large Dia} - \text{Small Dia}}{2 \times \text{Tangent of angle}}$$

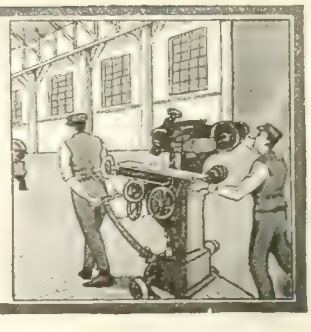




$$\text{Tangent of angle} = \text{Taper per foot} \div 24.$$

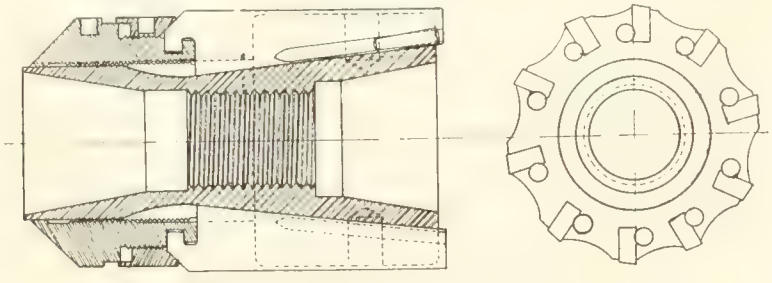
L. Dia	S. Dia	Length	T.P.F.	Tangent	Angle	Diff.
1.12		2.412	.4776			
2.46	6.50	6.250				
	3.210	2.240			20°	
	1.80			.8988		.7379
3.120		5.75	1.250			
3.40			6.270			2.650

DEVELOPMENTS IN SHOP EQUIPMENT



THE DAVIS EXPANSION REAMER

For a long time the old style of solid shell reamers were used, but with the constant improvement of other machine shop equipment, the necessity of a reamer whose blades could be expanded in a practical manner to compensate for wear, was keenly felt. Numerous types of adjustable reamers were placed on the market from time to time, the majority of which were controlled and locked with individual blade screws or pins. But none of these fully met all the requirements of the trade. The great percentage of these went into the discard, but there are still several types of adjustable reamers which have survived.



SECTIONAL VIEW OF THE REAMER.

Some time in the year 1909, Mr. E. E. Davis, general manager of the Davis Boring Tool Company of St. Louis, Missouri, also realized the necessity for a thoroughly practical expansion reamer. With the aid of his thorough knowledge of boring equipment and metal boring requirements, as well as an exceptional mechanical experience, he set to work solving the problem. The result was the Davis expansion reamer, one of the greatest improvements on record in the history of machine tools.

The entire principle and design of this tool were originated by Mr. Davis, and in December, 1912, a patent was taken out as a protection against infringement.

The distinguishing features of the Davis expansion reamer are simplicity and practical construction, with fewer parts than any other tool of similar type. All wearing parts are hardened. All threaded parts are protected from dust, chips or possible injury which might result from careless usage or accident.

The blades are positively controlled by an accurate micrometer adjusting dial, graduated in quarter thousandths, which acts for both expanding and receding of blades. The blades are slotted and fit over the ring on an adjustable dial which prevents their movement either way without turning the dial. When the reamer is set to size required the blades are individually and doubly locked to reamer body by a locking principle which positively locks the blades without the use of screws, virtually making a solid reamer in its entire principle.

Blade Efficiency

Davis expansion reamers require but three groups of blades to cover range of sizes from 1⅝ inches to 6 inches, inclusive. The large range of sizes covered, together with the greatest possible range of expansion, will show a decided increase in the number of holes reamed per set of blades.

When the blades for the 6-inch reamer are worn under size, they can be used in a number of smaller sizes down to and including 4-1/16 inches. Blades for the 4 inch reamer can be used in smaller sizes down to 2½ inches. Blades in the 2-7/16 inch reamer can be used in smaller sizes down to 1⅝ inches.

This is reamer blade efficiency at lowest blade expense, and means 100 per cent. to 300 per cent. more holes reamed per set of blades than with any other similar type of reamer.

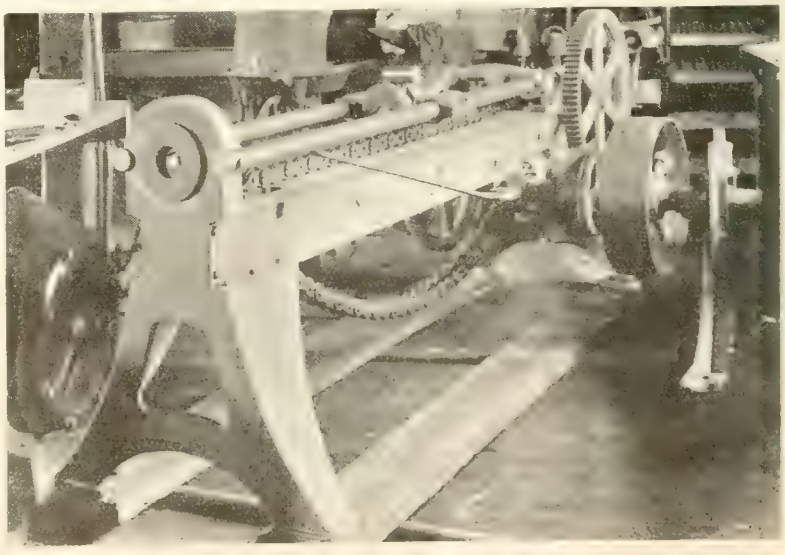
The Davis Boring Tool Company, Incorporated, are the originators of the forward movement of blades for the purpose of expansion in a tool of this type. This feature always keeps the blades cutting in advance of the tool body, consequently the blades never lose their bottoming feature.

DRAW BENCH

The Winterhoff Tool and Machine Co. of Elkhart, Ind., have placed on the market a new draw bench, as illustrated.

This machine is designed to draw tubes to a very thin wall, straight, and accurate gauge.

It is different from the usual type in that it is provided with guide rods that are in perfect alignment with pitch line of sprocket, and die hole in drawing head. It is also provided with safety stop that disengages hook from chain at any point desired. Chain is of standard roll link type and has a capacity of fifteen tons. Machine is back-geared to approximately 150 to 1.



GENERAL VIEW OF THE DRAW BENCH.

LABOR-SAVING SHOP TOOLS

The Liberty Tool Company, Baltimore, Md., is showing a number of new devices designed to effect time and labor saving in shop work.

PORTABLE DRILL PRESS

Portable Drill Presses

A portable drill press, designed to fit any make or shape of air drill having a vertical motor, is especially adapted for drilling and countersinking flange and plate work, such as firedoors, flue sheets and door sheets. This device has a 2¾-in. pneumatic feed end and is equipped with a sliding head taking any work from ½ in. to 14 in. thick. It will drill holes from ½ to 1 5-16 in. and countersink up to 2 in. in diameter.

A double cylinder portable drill press

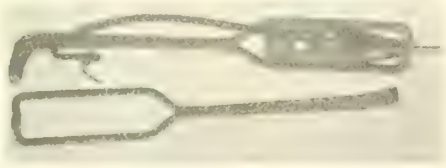
RIVET HEATING FURNACE.

with a crowfoot attachment is designed for any class of work and fits any of the pneumatic drills commonly used. It is equipped with a sliding head and a sliding table, has an 8 in. pneumatic feed and will drill holes up to 1 5-16 in. and countersink to 2 in. in diameter. It can be used as a radial drillpress up to 18 in. in diameter of hole circle and the sliding head can be adjusted to take work up to 11 in. in thickness.

PORTABLE HEATING TORCH

Rivet Heating Furnace

A portable rivet heating furnace using oil as fuel is designed so that the point of the rivet may be heated to any desired temperature, while the head is heated only to a cherry red or sufficient to readily conform to the work in the riveting operation. The top of this furnace is pierced with holes, through which the rivets are inserted, so that the point of the rivet is in the flame, while the rivet head rests on the outside or top of the furnace. The intensity and uniformity of heat may be regulated by means of a control valve.



HOLDING ON BAR

Portable Heating Torch

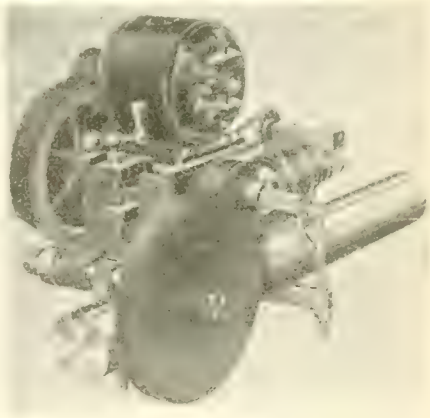
This apparatus consists of a fuel tank, a hose and a burner. The torch has one line of hose leading from the tank to the burner, which makes it convenient to handle in close places. This torch will heat to any desired temperature and may be used in the open air with excellent results.

Holding-On Bar

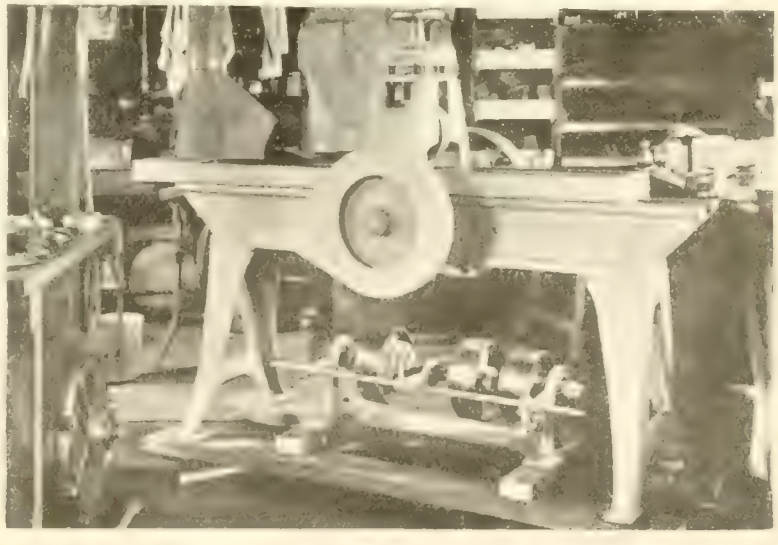
This holding-on or dolly bar has a pneumatic clamping device secured in a rectangular frame which is part of the bar itself. The bar can be placed in position quickly and the recessed end tightly clamped over the rivet. It may be readily applied in close quarters and is especially designed for use in locomotive flue sheet riveting and repair work. This company is showing a heading attachment for a riveting hammer, designed to rivet stay bolts and stay rods or countersink rivets and also a portable drill press for a close corner motor.

BUCHER-SMITH KEYSEATING MACHINE

The Bucher-Smith Co., East Liverpool, Ohio, is now manufacturing a portable motor-driven keyseating machine, in addition to its Style A hand-power machine. The machine shown is known as style A-2, and has a spur-gear drive. The sliding head is cast solid to the spindle; the feed screw, being inside the spindle, keeps the pulling strain close to the shaft. A power feed is furnished by a sprocket-chain connection from the main shaft to worm gearing on the screw. The depth of cut is regulated by the vertical screw shown above the cutter. The main shaft is squared on the end for a wrench, thus permitting hand-power operation if current is not available. The motor furnished is either alternating-current or direct-current and the power connection is usually the nearest lamp socket. The machine will cut keyways from ¼ to 1¼ in. wide by 12 in. long, and is suitable for shafts from 1¼ to 5 in. in diameter.



PORTABLE KEYSEATING MACHINE.



VIEW OF THE SEAM ROLLING MACHINE

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Ask the Men Who Have Gone Up

PREMIER DRURY has been speaking considerably on education, and in some respects at least he seems to be on the right track.

If he wants to get assistance in this matter he can do so by calling in some of the foremen and superintendents of shops who have come up through the ranks.

These men know what they were equipped with when they had to leave school. They know what was useful to them and they also know what they had in the way of surplus and useless knowledge.

They will all go back to the fact that they were not well enough equipped in the fundamentals of education. They wanted to know more about arithmetic and methods of doing it quickly. They wanted more reading and writing. They wanted these things and lots of them.

It would not be a hard matter to name a half-dozen men in the metal working lines who could give valuable advice along these lines. We mean men who did not have the advantage of a college education — men who started to learn a trade, and when at it a year or so found that they were up against a stone wall all because they did not know enough.

There is no doubt at all but that other lines of enterprise could furnish foremen and superintendents who have had the same experience.

Men who have gone through the mill, and who know what helped them through are in a better position than the finest book scholar in existence to advise those who want to make the public school curriculum suitable to provide that necessary "something" for the boys coming on now.

CANADIAN MACHINERY has no doubt that men who have worked and studied and burned the midnight oil to fit themselves for positions of responsibility and good salaries would be willing to sit down in conference with the provincial authorities and give them the benefit of dearly-bought experience.

Time To Quit Tinkering

HOW much longer can the state of industry on this continent continue to be tinkered with before it goes to smash?

A person hardly needs to be a pessimist to ask such a question. Certainly the most confirmed optimist can hardly close his eyes to the trend that events have been taking in recent months.

Just now we are coming to realize what the coal strike means. Not in Canada? Yes, but Canada is United States as far as the coal strike is concerned.

Go into the market to-day and try and buy steel and coal. Can you get them? You can not. Without any academic discussion on the merits or the demerits of the case, how are you going to get along without them? They are both basic purchases of the first water.

When officials of some of the miners' unions heard that the recommendation of the arbitrators awarded them fourteen per cent. increase, the expression alleged to have been used was "To hell with it!"

It is well that these words were used, because it brings into concrete form a spirit that has been rampant in an indefinable way for months.

"To hell with it!" is not nice language, neither is it good form to reprint it, but no other phase will statefully the frame of mind of many people on this continent who have the making or the breaking of our industrial prosperity in their hands.

The war has not taught the world very much. We made the sacrifice. It was enormous. It was ghastly and it was heart-breaking. We believed that the after-war period would see a kindling of the fires of love and tolerance and sacrifice in our national, industrial and individual lives. We had dared to think that somehow or other, from the furnace of suffering and death would come a conception of something higher and more worthy than money grabbing.

And to-day can you blame the man who looks around and asks where the improvement has come in? He sees strikes, discontent, probing into large profits, investigations into plots and uprisings against rulers and against governments. He does not see men in honor preferring one another, showing a spirit of kindliness and toleration.

Things are approaching the stage where the man who stands up now and tosses another monkey wrench into the wheel should be regarded as nothing less than the common enemy of all, and he should be dealt with accordingly.

THE International Association of Ash Sifters have officially opened the 1919-20 season. The slogan: "Dust thou art to dust returnest."

* * *

IMAGINE the good old days when a machine tool dealer could give you delivery in two weeks—and then was willing to stand back a spell and wait for his money.

* * *

MANY a salesman is successful on account of the things he does not say rather than for the things he does say.

* * *

SHORTER hours and less production will never remedy the condition this country faces. It is bound to mean lower wages and unreliable employment. The high mark for wages in Canada was in the munition shops, and those wages were possible on account of the high production secured.

Joins General Combustion Co.

NORMAN M. CAMPBELL

NORMAN M. CAMPBELL has resigned his position as general sales manager of Canadian Ingersoll-Rand Co., Limited, and as a director of that Company, having been appointed managing director of General Combustion Co., of Canada, Limited, with headquarters in New Birks Building, Montreal. He will assume his new duties on the first day of January next.

Mr. Campbell was born in Montreal in 1878, the son of Rev. Dr. Robert Campbell of that city. He was educated at Montreal High School, Abingdon School and McGill University, from which he graduated in 1899 with degree of Bachelor of Science.

On graduation he was appointed Assistant Engineer in the Waterworks Department of the Dominion Iron and Steel Co. at Sydney, during the construction of that Company's plant.

He joined the staff of the Canadian Ingersoll-Rand Co., Ltd., in 1900, as manager of their Toronto branch and was moved to Montreal to take a similar position there three years later.

In 1910, he was appointed general sales manager of the company, and during his tenure of that position he has had the satisfaction of seeing the Company grow from a very modest concern to its present status as one of the largest manufacturing plants in the iron and steel industry of Canada.

In the General Combustion Co. of Canada, Ltd., Mr. Campbell will have associated with him Dr. Milton L. Hersey and Mr. Henry H. Vaughan, both very well-known figures in engineering circles in Canada.

The Company was recently formed to exploit in Canada and Great Britain, industrial furnaces for annealing, forging, heat treating, etc., under the well-known Sklovsky patents, with the trade name of "OILGAS" furnaces, and from its inception it has been notably successful.

A Real Imagination

WE are indebted to "The Locomotive" for bringing this gem of pure imaginative effort to light. It is supposed that it was written by a member of the air service at Scott Field to his father and was found near the Southern Railroad Station.

"I have been appointed Mess Sergeant of the Flying Detachment, Scott Field, and to show of what my work consists, I will give some few examples of our tasks and efficiency.

"The kitchen range is 500 feet wide and 3,000 feet long, takes 27 experienced firemen to keep the heat at the necessary temperature, 400 cooks on duty at all times, 1,000 mechanical stokers for kitchen police and 1,000 assistant kitchen police who look after the stokers.

"Two hundred washing machines are used for washing the potatoes, 27 pile drivers mash them, 14 steam shovels shovel eggshells away from the kitchen door. Twenty-two Liberty motors are used in the coffee mills. Dirty dishes are hauled out to 11 blast furnaces, as the dishes are all paper and are burned after each meal. Hot cakes are mixed with 19 concrete mixers and 46 men with bacon rinds attached to their feet continually skate over the large griddle to keep it greased.

"Soup is made in an artificial lake, which keeps 34 dump trucks busy hauling the necessary ingredients. Cooks use steel boats and are dressed in asbestos clothing. Every few minutes they row to the centre of the soup lake and drop depth bombs to properly stir the mixture. Sixty-seven fire engines are used to pump soup to the 954 tables. Bread is cut by 11 high-powered band saws. A perforated endless conveyor properly salts and peppers the victuals. Twenty large street sprinklers are used to place syrup on cakes. Coffee is made in a 600-gallon tank and pumped to the tables through pipes by 17 centrifugal pumps. Ten five-ton rollers are used to roll the batter. To save labor and cost six-inch mains have been installed from 20 of the country's largest dairies for the supplying of milk.

"Radio telephones are used by the Mess Sergeant, who also uses a motor cycle in travelling around the dining hall and kitchen. All cooks wear gas masks. Ford trucks haul the silverware. Now, dear father, you can see just what I have to do and why I do not desire to quit the army."

The Old-fashioned Home

THERE is one place I like to go, of that there place I'll write—it's got your fancy dangled homes knocked higher'n a kite. To enter there's a tonic sure for every aching bone, that place is sure a wholesome one—a real old-fashioned home.

You seem to feel the home-like stuff before you're quite inside, there's not a touch of snobbery, of jealousy or pride.

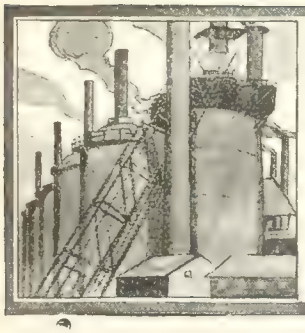
They haven't got those spindley chairs you fear to sit upon, nor the paper tinted to a shade betwixt the night and dawn. And cushions ain't piled up in hills, just to be squinted at; what's more, there is no Turkish rug nor Oriental mat.

But everything seems just to say, it talks as plain as mud, "Just come and rest your carcass here, you great big weary dub. It doesn't make no odds to me how hard or fast you sit, or whether you wear silk-lined gloves or just a home-made knit."

Perhaps the carpet's just as plain, 'twas rag made hit and miss, but it beams and shines and seems to say, this is a place of bliss. Folks like to joke about the words in mottoes on the wall, and 'bout the peacock feathers stuck resplendent in the hall. And if a spot appears upon the carpet by a chance, the folks don't throw a fit right off, or pass into a trance. It aint a very serious crime, it really aint, by heck—to spot a place upon the wall where flies have left a speck.

But sweet content is campin' there—it comes in like a flood, and you couldn't chase it out again with a broomstick nor a club. Let's toast the good old-fashioned home, with its dear old-fashioned airs, unspoiled by touch of higher art, nor cursed with three-legg'd chairs.—ARK.

IF PRICES and wages fall together, there is very little hardship on the individual, but on the other hand there is also very little benefit, and by far the best thing is for prices to fall and for labor costs also to fall by means of increased production. Increased production per man, with the help of improved appliances, may save the situation and enable us to retain and extend our industries at the time when severe foreign competition begins to operate and may even enable high wages to be paid, but without increased production the only conclusion possible appears to be that wages must fall or our industries will be killed. —*Machine Tool Review.*



MARKET DEVELOPMENTS

U. S. Rollers Do Not Want To Book Business

Canadian Buyers Find Trouble in Booking Tonnages at Large Mills—Looking for Higher Prices in 1920—Increases Are Noted in Wood and Metal-Working Machinery

SOME Canadian buyers have been in the steel district of the United States during the week in an effort to place business for future delivery. They found that rollers there were not anxious to discuss the proposition at all. In fact, it was intimated that some of the mills during the war had booked tremendous tonnages at current rates, and when the higher prices came they were not in shape to handle that business, being busy with the lower price contracts. They are not going to repeat that error, and to use the words of the buyer, they are not going to fill up on soup so high that they won't have room for turkey."

Indications point to higher prices for steel. The Corporation adheres to the schedule of March 21, but the Corporation can give no definite shipping promises. It seems likely that premiums will be frequent and of fairly large dimensions in the near future.

Increases are noted in machinery lines. One New York maker gives notice this week of a seven and a half per cent. increase. Woodworking machinery goes faster than that, and increases in the last three weeks in some lines, when brought to a Canadian basis, would amount to almost thirty per cent., coupled with a delivery schedule that was inclined to be vague.

Old Country high speed goods are coming on the market again. The Canadian trade used to be good for these lines, but since the war it has been a great place for U.S. goods that got a start in here during the war rush. Stock lists and quotations show an ability to meet competition being brought in some cases to a point where there is nothing in it for them. Apparently the makers consider that they can sell their output from the factory.

Shortage of supplies in the way of many lines that usually come from the U.S. steel mills, coupled with the shortage of coal, and the drastic methods that are being taken to meet the situation, do not help matters in the industrial world. They tend to create a hand-to-mouth policy, which precludes orders on a large enough scale to keep things moving in a good volume.

TOO LATE TO BRING SCOTIA COAL BY BOAT TO MONTREAL MARKET

Special to CANADIAN MACHINERY.

MONTREAL, Que., Dec. 11.—There is one ray of sunshine in the gloom of the present situation in the announcement that a satisfactory arrangement is expected this week in connection with the coal strike in the States; not that such action will offer any immediate relief to the existing conditions, but it will enable business to become more stabilized and permit of a more definite policy for trade developments and general industrial operations. Local plants have not been seriously affected by the inability to obtain coal, as many firms were well stocked with fuel when the strike came into force. The near approach to the close of navigation and the consequent increased difficulty of securing supplies were factors that were arousing considerable concern, but the prospects of a near settlement of coal troubles in the States has removed much of the tension of the past few weeks, but dealers and manufacturers realize that all is not smooth running yet, and that every precaution will have to be taken to conserve available supplies, as it will be many weeks, or even months, before the lost production can be made up and shipments normal. There has been some talk of bringing supplies from the Maritimes, but with the St. Lawrence closed, this would entail long haulage over the railroads—almost a prohibitive practice. Recent export trading has been somewhat adversely affected by the low British exchange rate, a factor that prevents expansion of Canadian export trade.

Steel Supplies Falling Off

Apart from the possibility that the coal strike in the States may be terminated this week, there is little new in the present industrial situation. Conditions here have not been acute, but the disturbances in the American coal fields, and the uncertainty of fuel shipments to Canada, have gradually increased the tension in regard to the continuance of industrial operations. Curtailment of productive activities, which have become so general in the States, has not been found necessary here, as yet, although the attitude of the U. S. authorities in withholding coal shipments has caused some unfavorable comment in Canadian business circles. The present demand for steel and the inability to supply the same would be ample excuse for a higher price on finished materials, but large producers are apparently not departing from the policy of keeping the quotations from soaring to runaway figures, which would be the case if a lead was once given. Whatever is being done in the way of premiums there is little appearing on the surface to indicate that transactions are carried on on other than the quoted basis. Dealers here report difficulties in getting materials shipped in from the States, and long delays are frequently recorded, even after the stuff has left the mills or the warehouses. Local stocks are not all that could be desired and in such lines as sheets, plates and tubes, it is only in the less-called-for sizes that stocks are reported, and even here the supply is gradually falling. The

general market is strong and quotations given should only be considered as nominal.

Dealers Await Developments

Nothing of importance has developed in the old material situation and the dealers are still waiting for something to turn up that will revive the demand. The disturbed state of industry across the line has not been conducive to the buying of scrap and local trading is not in sufficient volume to cause other than normal comment. Shipment of scrap out of the country has fallen off considerably, and in consequence the present market has a weak tendency. Dealers are looking forward to better buying in a week or so, as reports point to an early resumption of coal mining operations. It will be some time, however, before normal steel operations can be resumed, as it will require some little time to restock depleted coal piles. Dealers are holding to quoted prices, but state that they are of a nominal character, and governed by individual transactions.

TENDENCY NOW IS MUCH HIGHER

And U. S. Mills Are Not Anxious to Take on Much Business for 1920 Delivery

TORONTO.—Prices have crowded into the centre of the stage as far as the machine tool and iron and steel market is concerned. There may be some price lists that still exist as absolute, but they are becoming more infrequent, and the tendency seems to be to withdraw all quotations, and give prices on request for actual delivery. This is not a very satisfactory way of doing business for either the consumers or the dealers, but it is about the best that can be done now.

The Machine Tool Market

The market for wood working machinery is just as uncertain as in the metal working lines. There are cases where makers of machinery have made advances as high as twenty per cent., which, in this country, would be worth thirty per cent. on account of duty and exchange. Metal working machines are more firm in regard to advances, and few have been made during recent weeks. It amounts to practically the same thing, however, as many builders refuse to quote any price at all for future deliveries. As far as can be seen they are willing to accept business for future shipment, but only on the understanding that price shall be that which is prevailing at the time of delivery.

This is being reflected in the used machinery trade. One dealer informed CANADIAN MACHINERY this week that instructions had been sent out to hold up all prices quoted on used equipment, as there would likely be a revision in the near future.

Cutting Prices Now?

Some of the salesmen handling certain lines of high-speed goods complain that prices are being cut below where they can make any money in the business. It is hard to explain why, but it is a fact that U.S. concerns are now paying net list for high-speed cutters, while in Canada the price is ten off. This has been the prevailing price for some time, but just recently quite a lot of buying has been done at ten and ten off. The jobber complains that he can do nothing at this price. Of course, it is all right for the concerns using the cutters, as they are getting a close price, and they know it. English firms are getting in shipments of high-speed once more. Prior to the war the high-speed steel market in this country was largely in the hands of the British makers, but during the time of the war, owing to the need for material at home, and the inability to get shipments through, the business passed largely into the hands of American firms. It is evident that British makers are out now to get a slice of that market back again, as they are putting in their high-speed goods in some cases at a price which is ten per cent. better than the local quotations.

The Market For Steel

As far as the jobbers are concerned, price lists appear to have ceased to exist. They may still be in existence for the guidance of buyers, but for actual transactions in sheets, plate, tube, etc., they have passed out for the time being. Figures have not been quoted elsewhere in CANADIAN MACHINERY as these lines are simply nominal. When a house was notified to offer in the way of sheets or plate it might as well quote ten dollars as one dollar.

Bar mills in this country have gone up $7 per ton in the last three weeks. United States mills, according to Canadians who have been over the ground recently, are not in good shape, or at least they are not taking on business. It looks very much as though some of the mills were looking for better prices in the spring, and are not inclined to book up at present quotations. It may be that they even expect prices to mount rapidly when the spring rush comes, as it surely must come.

Here is the way one Canadian buyer sized the situation up for CANADIAN MACHINERY: "It looks to me as though the mills in United States had profited by the lessons they learned during the war. At that time they booked away ahead, and piled up enormous tonnages. The result was that they were kept busy grinding away on this stuff at a set price, while other mills with not such great bookings were at liberty to go out and take on business that was pressing for delivery and therefore willing to pay a higher price. As one of the U. S. men stated the case a few days ago: 'We do not propose to be caught as we were during the war. Then we were so filled up on soup there was no room for turkey when they passed it to the mills. This time we are going easy on the soup and we are going to sit up when the turkey comes.' Which is another way of saying that they intend to roll easily for the present and when the higher prices become common they will roll seriously."

The independents are acting pretty much together at present taking their lead from the Corporation. The Corporation is becoming pretty well booked ahead and will not promise anything in the way of deliveries, although adhering to the prices of March 21. It is figured out now that the independents realize that urgent buyers will be in the market and prices are liable to soar in proportion to the urgency of each separate case.

POINTS IN WEEK'S MARKETING NOTES

One maker of latnes has notified the New York market that he is making a seven and one-half per cent. increase in his selling prices, effective at once.

—

Advances are recorded in several lines of wood-working machinery, some of them, by the time they reach this country, amounting to as much as 25 and 30 per cent.

—

English high-speed goods are coming on the market here once more. For some time American goods have held this market on account of the inability of British makers to ship here.

—

Dealers claim that prices are being shaved again on high-speed cutters. U. S. buyers get these at net list, while Canadian prices are ten off, and some fairly large orders have been taken at ten and ten off.

—

Canadian buyers going into the United States to place plate and sheet business find the mills there not anxious to talk future orders at all. Apparently higher prices are in store in the spring, and many of the mills want to be in shape to roll at the new quotations.

—

Scrap metals are dull this week. Coppers are apparently now at their low mark, and improvement is anticipated. Iron and steel are holding at the advances that were marked up for them last week. No. 1 machinery scrap is very much in demand.

—

Tin plate rollers are closing down first in United States, as steel for that purpose has to be heated six times. Curtailment on other lines is necessary on account of coal and coke shortage.

—

Iron and steel jobbers have for the most part taken their quotations in for the present, prices being given on application for certain definite lots.

The mills at the Soo of the Algoma Steel Corporation are busy now, having a lot of business on their books, especially in the merchant bar mill. The demand is very strong for small bars, reinforcing bars structurals the Soo mill now rolling up to 15 in. in the latter.

The Non-Ferrous Markets

Coppers are showing a little more strength, but the market is crowded with material, owing to the manner in which United States exchange is working against business being done in that country. It might also be mentioned that speculators who had bought some time ago in the hope of a rise in the copper market are having a merry time trying to hang on in hopes of a better chance for them turning up in the near future.

Scrap Not Active

Coppers in the scrap market are weak, with little demand either way from dealers to users or from pickers to dealers. The steel and iron section is stronger and holding well at the advanced prices that were marked up last week.

Mr. J. H. Laroche, of Ste. Croix, Quebec, has written to CANADIAN MACHINERY asking where he can secure No. 1 machinery scrap, and what he will have to pay for a car load.

MACHINE TOOL TRADE NOT HURT MUCH BY THE COAL STRIKE YET

Special to CANADIAN MACHINERY.

NEW YORK, December 11.—It is a matter of some surprise to the machine-tool trade that business has held up so well in spite of the somewhat uncertain industrial outlook brought about by the coal situation. The explanation may be that far-seeing manufacturers do not anticipate any long-drawn-out coal strike and are preparing to take advantage of the backed-up demands for all products that may exist when the coal shortage has been overcome. Deliveries on nearly all standard tools are now from two to four months or longer overdue, and if coal shortage affects output of machines, as it is very likely to do, these deliveries will be extended even further, without any increase in business. Therefore, those who have faith that the industrial situation will right itself within several weeks, at the most, are not loath to place their orders to insure reasonable delivery.

The General Electric Co. is one of the most active buyers, so far as quantity is concerned, but there is general buying of small lots of tools which extends to manufacturing plants in nearly all metal working lines. The General Electric Co. will buy equipment for its two new plants at Rochester, N.Y., and Decatur, Ind. The latter plant will make small motors. It is reported that the company has received a contract for one million vacuum cleaner motors. The New Departure Mfg. Co., Bristol, Conn., has not quite completed its buying as more tools will be purchased soon for its coaster brake department. One large machine-tool concern received an order from this company for $600,000 worth of tools. The Willys Corporation, Elizabeth, N.J., is buying tools almost every day for the additions at its plant. It will be about June 1920, before the company gets on a real production basis on its new six-cylinder light automobile. Equipment will also be bought soon for another unit of the Willys Corporation, the plant of the Electric Auto-Lite Co., Poughkeepsie. The Dupont Motors Corporation, which is building a new automobile plant at Wilmington, Del., will be in the market for equipment soon, so also will two other Eastern automobile companies, the Rolls-Royce Co., Springfield, Mass., and the Stevens-Duryea Co., Chicopee, Mass.

The Nathan Mfg. Co., New York; the Mergenthaler Linotype Co., New York; the Newport News Shipbuilding & Dry Dock Co, Newport News, Va.; the Traylor Engineering & Mfg. Co., Allentown, Pa.; the International Motor Co., Allentown, Pa., and the De Laval Cream Separator Co., Poughkeepsie, N.Y., are among the companies which have come into the market for small lots of tools.

An officer of the Greek navy is in this country to confer with machine-tool builders relative to a list of equipment for a naval air station to be built in Greece. The equipment has been figured on in England, but a part of it may be bought in the United States owing to the high prices prevailing in England.

A leading manufacturer of turret lathes has advanced prices 7½ per cent.

SHUTTING OFF SOME MILLS NOW BECAUSE COAL AND COKE ARE SHORT

Special to CANADIAN MACHINERY.

PITTSBURGH, Dec. 11.—Last week, when the coal strike had already lasted four weeks, occurred the first noticeable curtailment in steel mill operations, while predictions were that if the coal strike continued a fortnight longer a large part of the industry, perhaps half, would have to close. Nevertheless coal production has been increasing, by the non-union mines doing better, and by a union mine here and there resuming production. The explanation of the currents thus crossing is of course that the steel mills had been operating chiefly on their stocks of coal, and these stocks were nearing exhaustion.

Inasmuch as the steel is heated six times in the process of making tin plate, it is not surprisng that the first cases of mill closing reported were tin mills, including the American Works, Elwood, Ind., and the Gary tin plate department, both of the American Sheet & Tin Plate Company, and of some at least of the tin mills of the Trumbull Steel Company, Warren, O.

With only a gradual increase in coal production this closing of mills will spread, there being many requirements more essential. Only a practically complete resumption of the union mines can put the steel industry in an easy position, but if there is such resumptions the industry will be relieved almost at once, since there are stocks of coal held by the railroads for distribution to the most important uses, and these would be released as soon as it became known that fresh supplies were coming. Closings, if they occur, will probably affect the rolling and finishing of steel somewhat more than the making of steel. Even now some mills are husbanding their coal by putting steel through the finishing processes that require the smallest quantity of coal per ton of product.

By the order determined upon by the Fuel Administration, Dec. 2, the production of beehive coke is being restricted about 25 per cent., the regulation being effected through the medium of car supply for coke loading. In Connellsville region the regular procedure is likely to be for the railroads to furnish no coke cars Wednesdays and Thursdays, coal cars being furnished on those days. There has been a rush on the part of blast furnaces to pick up any lots of furnace coke available, and in the space of one week the market price of Connellsville furnace coke for spot shipment advanced from $6.25 to $10, on transactions involving very limited tonnages. Some conservative coke operators deplored the advance, but had no coke to offer at the prices they considered reasonable. Some of the buyers were furnace interests whose supplies from other coke fields, or from their by-product operations, had been decreased, while others were regular customers of the Connellsville region who desired to gather up a surplus against contingencies.

The Iron and Steel Strike

All interest in the iron and steel strike is now lost, the coal situation being of vastly more consequence than what little remains of the iron and steel industry's own strike. The Wheeling district remains largely closed with rumors, denied at strike headquarters, that the strike in general has been called off. At various other points there remain some strikers, but the mills where they remain strikers are more interested in lining up the men in employment and organizing them into efficient working units again, than in getting more men into employment. Even in the Mahoning valley, which next to the Wheeling district has held out the longest, some mills are turning away an occasional applicant for a job, as they either do not need the man at all or are not ready for him.

Pig Iron Movement May Be Over

There are distinct suggestions that possibly the pig iron buying movement is about over, in which case the remarkable rise in prices will stop. Inquiry is certainly much less widespread, but whether that is because consumers are now well covered in most cases, or because the consumers remaining uncovered feel that the advance has gone too far to make it worth while for them to cover now, is uncertain. It is learned that there was a considerable volume of speculative buying, particularly of Buffalo and Eastern Pennsylvania iron, in the advance, and the speculative holdings may disturb the market at some later time.

An effect of the advance in pig iron has been to encourage the Connellsville coke operators to demand more money for coke for 1920 delivery and most of the furnaces that have closed for coke have had to pay large advances. Another effect may be to encourage an advance in Lake Superior iron ores for the 1920 season, whereas a month ago it seemed certain that the ore interests would be quite content to go along for another season at the established prices. The furnaces will be consuming 1920 ore into May or June of 1921 and if the pig iron advance they have brought about does not hold they may find themselves not much ahead in the final reckoning.

Foundry and basic grades are no higher than a week ago, being at $33, valley, equal to $34.40, delivered Pittsburgh, but Bessemer has scored an advance of $1 a ton, to $35, valley, two sales having been made at this price, one of 500 tons for December and one of 3,000 tons for equal deliveries over the first half of 1920.

Steel Prices

The finished steel market has not gained perceptibly in strength in the past week, except perhaps in the case of small lots from stock. The chances of the mills that are out for the highest prices obtainable are not as favorable and the policy of these producers, including the Steel Corporation, of adhering strictly to the March 21 price schedule stands better chances of dictating the general market level. For a time it was maintained in some quarters that the mills adhering to the old prices would become so hopelessly over-sold that the market would be thrown into the hands of the mills that intended to get the highest prices obtainable. This the March 21 price mills are endeavoring to avoid by limiting their sales to regular customers and in many cases, furthermore, by cutting down the tonnages inquired for. Undoubtedly there will be demand for many months to come for all the steel that can be made, the only issue being as to prices exacted. Export offerings are extremely limited and are likely to continue so, more or less, but as there will probably be little disposition to limit prices in the case of export business there may be considerable incentive to sell for export. The uncertainties of the foreign exchange situation help to discourage mills from forming any definite export policy.

The Week's Events in Montreal Industry

Preparations are being made by the management of the Canadian National Railways to haul from the Eastern seaboard all the available supplies of coal as a reserve, should the tie-up across the line continue. It is expected that when the details have been completed, not a single empty car will be brought back from the Maritime Provinces to either Ontario or Quebec, but that these empties, which are constantly moving from the seaboard to the interior, will be utilized to haul in a big reserve supply for the interior provinces. This will then be available should it be needed for emergency.

After a period of unrest of several weeks a strike of the miners of the Minto Coal Company at Minto, N.B., has become effective and the mines are now practically idle. It is estimated that about two hundred men are involved, and the normal production of coal that will be affected wil be approximately 350 tons per day.

Capt. E. J. Edwards has been appointed Trade Commissioner for Montreal, succeeding G. T. Milne, who will join the British Legation in Cuba as commercial secretary. Mr. Edwards is now in England but will leave there shortly to assume the duties of his new office. He has been associated with the British Naval Service and latterly as sales manager of a large manufacturing firm.

Considerable interest has been aroused over the proposal to erect a sixteen-storey hotel on one of the main streets of Montreal. One of the obstacles to the scheme is that of the existing by-law restricting the height of buildings to ten storeys. It is possible that this objection will be overcome by issuing a special permit, provided no great expense is incurred by the city in the matter of suitable water supply and fire protection.

The Elder-Dempster cargo steamer "Bassa," which grounded in the mud of the harbor on November 28 when clearing for South Africa, has been successfully floated after a week's effort to free her from the fixed position. It was necessary, however, to remove a large portion of her cargo before sufficient buoyancy could be obtained for the final release. She is now in drydock at Vickers undergoing light repairs.

The settlement of the strike of freight handlers at St. John, N.B., has been negotiated and the men are all back at work and the port is again resuming normal activities. For some time ocean traffic has been diverted to other terminals and St. John has suffered considerably but shipping men are more encouraged as to the future prospects. It is estimated that nearly half a million dollars was lost to the port as a direct result of recent disturbances and loss of business.

The Marconi Wireless Telegraph Company of Canada has purchased the four-storey stone structure at 11 St. Sacrament St., Montreal, and will utilize the greater portion of it for the main offices of the company. This building was originally erected for the Montreal Stock Exchange. The offices will be entirely remodelled and the building known as the Marconi Building. The company will still retain the factory on William Street. It is also proposed to open a school for the training of wireless operators.

S. P. Brown, the engineer who was in charge of the construction work on the Mount Royal tunnel, was drowned last week in Sebec Lake in Maine. He was dragging his nine-year-old son on a sled at the time when the ice gave way beneath him. Before assistance could be obtained he sank. Mr. Brown was an American citizen but superintended the planning and the subsequent building of the tunnel, one of the most important works of its kind ever undertaken, it being a record achievement both as to the time in putting through the hole and the successful working out of the details of construction.

At a recent meeting of the Montreal branch of the Engineering Institute of Canada, the subject of returning the railroads back to private ownership was presented to the members by W. F. Tye, the well-known railroad authority. The speaker went very thoroughly into the subject and commented on the general success attained by roads under private control. It is the opinion of Mr. Tye that the only solution to the transportation problem was for the Government to give decided increases in freight rates, and after putting the roads in first-class shape, organize new companies to take over the roads and operate same as private concerns.

T. B. Macaulay, president of the Sun Life Assurance Company of Canada, who has recently returned from a visit to the West Indies, addressed a recent meeting of the Montreal Board of Trade on the subject of "Relations With the West Indies." Mr. Macaulay is quite enthusiastic over the trade possibilities with these colonies, and believes the time is opportune for Canada to share extensively in the development of the West Indies, not in the sense of union with this country, but in close co-operation with local authorities and business houses, believing that close co-ordination between the colonies is essential to Empire progress.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$33 00
Lake Superior, charcoal, Chicago	38 40
Standard low phos., Philadelphia	40 00-40 00
Bessemer, Pittsburgh	35 00
Basic, Valley furnace	30 00
Toronto price:—	
Silicon..2.25% to 2.75%	$37.00 to $40.00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 4 25
Steel bars, base, Toronto	4 25
Steel bars, 2 in. to 4 in. base	5 50
Steel bars, 4 in. and larger base	6 00
Iron bars, base, Montreal	3 75
Steel bars, base, Montreal	3 75
Reinforcing bars, base	4 50
Steel hoops	5 50
Norway iron	11 00
Tire steel	5 50
Spring steel	8 00
Brand steel, No. 10 gauge, base	4 40
Chequered floor plate, 3-16 in.	7 50
Chequered floor plate, ¼ in.	7 00
Staybolt iron	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	2 35
Tank plates, Pittsburgh	2 65
Structural shapes, Pittsburgh	2 45
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small sapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

	Per 100 Pounds. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross.	
Lake copper	$24 25	$24 00
Electro copper	24 00	24 00
Castings, copper	23 50	24 00
Tin	57 50	60 00
Spelter	10 00	10 75
Lead	8 25	8 75
Antimony	10 50	10 50
Aluminum	33 00	35 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ½ up	$ 5 00	$ 5 00
Plates, 3-16 in.	5 25	5 25

Price List No. 38

WROUGHT PIPES

Standard Buttweld

⅛ in.	$ 6 00	$ 8 00
¼ in.	4 68	6 81
⅜ in.	4 68	6 81
½ in.	6 21	7 78
¾ in.	7 82	9 95
1 in.	11 56	14 71
1¼ in.	15 64	19 90
1½ in.	18 70	23 76
2 in.	25 16	32 01
2½ in.	40 37	51 19
3 in.	52 79	66 94
3½ in.	67 16	84 18
4 in.	79 57	99 74

Standard Lapweld

2 in.	38 81	35 34
2½ in.	42 12	52 36
3 in.	55 08	68 47
3½ in.	69 00	86 94
4 in.	81 75	103 00
4½ in.	93	1 18
5 in.	1 08	1 37
6 in.	1 40	1 78
7 in.	1 83	2 32
8L in.	1 93	2 44
8 in.	2 22	2 81
9 in.	2 66	3 36
10L in.	2 46	3 12
10 in.	3 17	4 02

Terms 2% 30 days, approved credit.

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4" and under, 40%, 4½" and larger, 20%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$14 00	13 75
Copper, crucible	17 00	17 00
Copper, heavy	17 00	17 00
Copper wire	17 00	17 00
No. 1 machine composition	15 25	16 00
New brass cuttings	11 00	10 75
Red brass cuttings	14 00	14 75
Yellow brass turnings	8 00	9 00
Light brass	6 25	7 00
Medium brass	7 25	7 75
Scrap zinc	6 00	6 00
Heavy lead	5 00	6 00
Tea lead	3 75	3 50
Aluminum	18 00	18 00
	Per Ton	Gross
Heavy melting steel	13 50	16 00
Boiler plate	13 50	11 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	14 50	16 00
Malleable scrap	18 00	20 00
No. 1 machine cast iron	24 00	25 00
Pipe, wrought	9 00	9 00
Car wheels	20 00	20 00
Steel axles	20 00	20 00
Mach. shop turnings	7 00	11 00
Stove plate	22 00	21 00
Cast boring	10 00	11 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	15
Carriage bolts, 7-16 and up	Net
Coach and lag screws	30
Stove bolts	50
Wrought washers	50
Elevator bolts	5
Machine bolts, 7-16 and over	10
Machine bolts, ⅜" and less	20
Blank bolts	25
Bolt ends	10
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square blank	add $1.50
Nuts, square, tapped	add 1 75
Nuts, hex., blank	add 1 75
Nuts, hex., tapped	add 2 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	40
Sq. and Hex. Head Cap Screws	35
Rd. and Fil. Head Cap Screws	5
Flat But. Hd. Cap Screws	10
Fin. and Semi-fin. nuts up to 1 in.	35
Fin. and Semi-fin. nuts, over 1 in., up to 1½ in.	25
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	10
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$43 00
Open-hearth billets	43 00
O.H. sheet bars	46 00
Forging billets	56 00
Wire rods	55 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$4 95
Cut nails	5 00
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 32
British Manila rope	0 26
New Zealand hemp	0 26
Transmission rope, Manila	0 43
Cotton rope, ¼-in. and up	0 80

POLISHED DRILL ROD

Discount off list, Montreal and Toronto ..... net

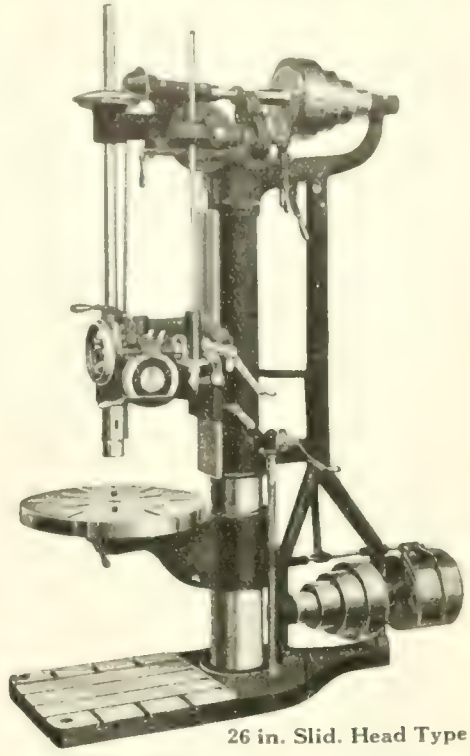
A Complete Line 8 in. to 50 in. Swing
with or without tapping attachment

BARNES

Upright Drills
Horizontal Drills
Gang Drills

Accuracy—Strength
Convenience of Operation

Carried in Stock by



26 in. Slid. Head Type

THE A. R. WILLIAMS MACHINERY CO., Ltd., 64 FRONT ST. WEST TORONTO

MONTREAL ST. JOHN, N.B. WINNIPEG VANCOUVER HALIFAX BUFFALO, N.Y.

Acid Electric STEEL CASTINGS

Acid Electric Steel Castings show superior ability to resist wear and crystallization. They are smooth in texture, free from Blow Holes, and machine perfectly. We specialize in

Railroad and Other High Grade Castings

up to 15 tons, any specification. Electric Steel Castings COST NO MORE than ordinary Steel Castings.

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MORROW SCREWS MORROW

Set and Cap Screws

Made from material specially prepared for this purpose and each "*Morrow*" Screw has a finishing die rim over it—*Result: Tenacity, Accuracy.*

Twist Drills

Made from the most expensive and highest grade Sheffield steel, **Jessops**, and our expert tempering process—*Result: Morrow Drills do more work with less re-grinding.*

Reliable jobbers carry them.

Works at

Ingersoll Canada

Machinists prefer Ingersoll Files because "they cut faster and wear longer"

DRILLS FILES

MORROW NUTS MORROW

If interested tear out this page and place with letters to be answered.

MISCELLANEOUS

Solder, strictly	$ 0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Lead wool, per lb.	0 14
Putty, 100-lb. drums	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 50
Linseed oil, raw, single bbls.	2 90
Linseed oil, boiled, single bbls.	2 92
Plaster Paris, per bbl.	4 50
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes up to 52	40
S.S. drills, wire sizes, No. 53 to 80	40-10-5
Standard drills, all sizes	40-10-5
3-fluted drills, plus	10
Jobbers' and letter sizes	40-10-5
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	net
Drills and countersinks	5% off
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	20 to 40
Canadian high speed cutters, net	to 10 off
American	plus 40

COLD ROLLED SHAFTING

At mill	list plus 5%
At warehouse	list plus 25%

Discounts off new list. Warehouse price at Montreal and Toronto

IRON PIPE FITTINGS

Malleable fittings, class A, 20% on list; class B and C, net list. Cast iron fittings, 15% off list. Malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings; class B black, 24½c lb.; class C black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.O.B. Toronto.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 6 55	$ 6 75
Sheets, black, No. 10	6 00	6 00
Canada plates, dull, 52 sheets	8 50	7 10
Can. plates, all bright.	8 50	8 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	....	....
Fleur-de-Lis, 28 B.W.G.	....	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28 U.S.	....	8 20
Premier, 10¾ oz.	....	8 50
Zinc sheets	20 00	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ¼ in., $9.75; ⅞ in., $9.20; ¾ in., $9.30; ⅝ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 00	.....
1½ in.	30 00	26 50
1¾ in.	32 00	26 50
2 in.	31 00	26 00
2¼ in.	35 00	28 00
2½ in.	43 00	32 00
3 in.	48 00	40 00
3½ in.	.....	41 00
3½ in.	60 00	42 00
4 in.	75 00	56 00

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	24½
Machine oil, per gal.	36
Black oil, per gal.	15
Cylinder oil, Capital	58
Cylinder oil, Acme	45
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls. net	8

BELTING—No 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30, 10%
Cut leather lacing, No. 1	2 20
Leather in sides	1 75

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	4 00
Polishing wheels, bull-neck	2 25
Emery in kegs, American	06
Pumice, ground	06
Emery glue	35
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	50
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	19½	Atlas	17
Peerless	19	X Empire	15½
Grand	18	Ideal	16
Superior	18	X Press	14
X L C R	17		

Colored

Lion	15	Popular	12
Standard	13½	Keen	10½
No. 1	13½		

Wool Packing

Arrow	25	Anvil	15
Axle	20	Anchor	11

Washed Wipers

Select White	11	Dark colored	09
Mixed colored	10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$11 50
Sheets, 3½ lbs. sq. ft.	10 50	11 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	10 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .25
Acid, yhdrochloric	.04
Acid, nitric	.10
Acid, sulphuric	.04
Ammonia, aqua	.13
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulpuret	.50
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy.	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulpate	.16
Nickel carbonate	.32
Nickel sulpate	.18½
Potassium carbonate	.50
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.18
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.75
Zinc chloride, C.P.	.30
Xinc sulphate	.08

Prices per lb. unless otherwise stated

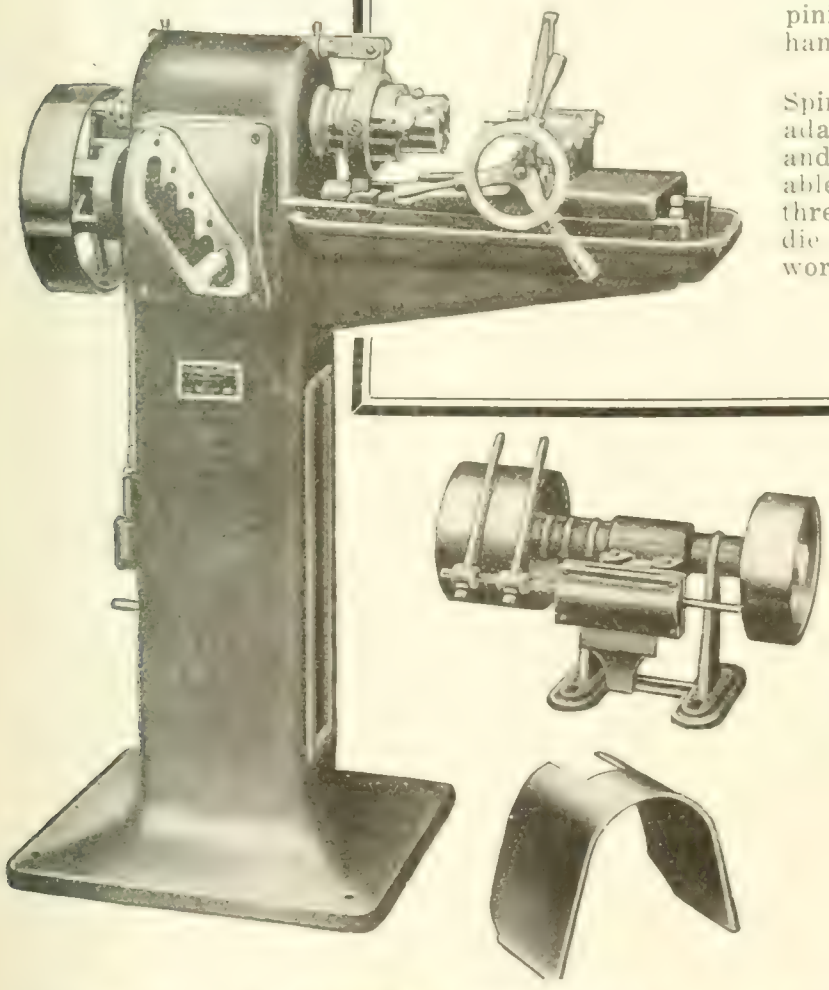
THE GEOMETRIC WAY

Where quantity and exactness have to be considered, the Geometric Threading Machine is just the way that suits. These machines have been tested and proved over and over again on speed, accuracy and endurance.

Geometric Threading Machines are employed on a large class of small threaded parts that cannot be produced economically on the ordinary screw machine.

Made in three sizes—to cut $\frac{1}{8}$ to $\frac{1}{2}$ inch, $\frac{1}{4}$ to $\frac{3}{4}$ inch, and $\frac{3}{4}$ to $1\frac{1}{2}$ inch diameter threads. The carriage is mounted on slides and on the largest size machine is moved back and forth by rack and pinion, and in the smaller sizes by hand.

Spindle speed changes readily made, adapting the machine to the diameter and material of the work. An adjustable stop assures accurate length of thread, and automatically opens the die head, permitting of drawing the work straight back.



A line from you brings full details regarding this machine. Tell us your threading requirements — let us recommend the proper Geometric Collapsing Tap or Self-opening die.

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If interested tear out this page and place with letters to be answered.

Henry Ford's View on a Very Vital Question

In the issue of the Dearborn INDEPENDENT, *on "Mr. Ford's Page," which appears this week, is the following article. It discusses the amount of profit in a day's wage. How much does it cost a man to produce a day's work?*

How much profit does a workman reap from his day's labor? How much ought he to reap? Does a "good living" come under the head of profit, or is it properly a part of the cost ofproducing a day's labor? How far can human energies be measured and human values standardized in order that the cost of a day's labor may be standardized?

Questions like these occur in one period or another of every man's thought about a system of economics which shall be more solidly based than any which serves us now.

But a more than academic interest attaches to these questions, for they are the real, even if unspoken, basis for much of the irritation and confusion which exists in the industrial world today.

The workingman is beginning to understand that he is in business. His raw material is human energy. His product is a day's work. All other business men seek a profit above cost of production, why should not he?

The difficulty thus far has been in making out the cost sheet. How much does it cost to produce a day's work?—that is the question for which there seems to be no satisfactory basic answer.

It is perhaps possible accurately to determine—albeit with considerable interference with the day's work itself—how much energy the day's work takes out of a man. But it is not at all possible to accurately determine how much it will require to put back that energy into him against the next day's demands. Nor is it possible to determine how much of that expended energy you will never be able to put back at all—because a "sinking fund" for the replacement of the body and vital strength of a worker has never been invented.

It is possible, however, to consider these later problems in a lump and provide for them under a form of old-age pensions; but even so, we have not thus attended to the question of profit which each day's labor ought to yield in order to take care of all of life's overhead, all physical losses, and the inevitable deterioration which falls upon all earthly things.

Moreover, there are questions having to do with the pre-productive period, which would have to be solved. Here is the man, let us say, ready to begin his service to society by turning out days' work throughout his life. How much did it cost to rear and educate him to his present age and usefulness? And how can that be figured as part of the cost of the energy he puts forth as he works to-day? Now, if it were the case of a machine, you would know what to charge. The machine cost a certain sum; it wears out at a given rate; it would cost such-and-such an amount to replace. It is a simple matter to figure the actual cost of the machine and its productive work, and add the profit.

Can we do that with men? Rather, can men do that for themselves, so that

> THIS article discusses the amount of profit in a day's wage. How much does it cost a man, in strength, money and ability, to produce a day's labor? How much profit ought he to receive on that outlay? How can basic figures be obtained on these matters?

selling a day's work they will have as intelligent an idea of the cost of that day's work and the profit it ought to bring, as any manufacturer ought to have of his product?

The problem becomes more complicated when you consider the man in all his aspects. For he is more than a workman who spends a certain number of hours at his work in the shop every day.

If he were only himself, the cost of his maintenance and the profit he ought to have would be a simple matter. But he is more than himself. He is a citizen, contributing by his cultivation and interest to the welfare of the city. He is probably a householder, living under conditions which represent more than mere maintenance, in that they represent the graces of social life. More than that, he is probably a father with more or less numerous progeny, all of whom must subsist and be reared to usefulness on what he is able to earn.

Now, it is obvious that to regard the man alone, refusing to reckon with the home and the family in the background, is to arrive at a series of facts which are misleading and which alone can never suffice even for a temporary solution of the questions that concern us.

How are you going to figure the contribution of the home to the day's work of the man? You are paying the man for his work, but how much does that work owe to his home? How much to his position as a citizen? How much to his position as the provider of a family? The man does the work in the shop, but his wife does the work of the home, and the shop must pay them both: on what system of figuring is the home going to find its place on the cost sheets of the day's work? It finds its place there already in a sort of haphazard way. If a man cannot support himself, his wife, his children, his habitation, his position in society—why, he doesn't stay at the job, that's all. It isn't a matter of cost and profit to him; it is the matter of a "living."

Is a man's own livelihood the "cost"? And is his ability to have a home and a family the "profit"?

Is the profit on a day's work to be computed on a cash basis only measured by the amount a man has left over after his own and family's wants are all supplied?

Is the livelihood of five or six persons beside those of the actual worker to be charged up to "profit"?

Or, are all these relationships to be considered strictly under head of "cost," and the profit to be computed entirely outside of them? That is, after having supported himself and family, clothed them, housed them, educated them, given them the privileges incident to their standard of living, ought there to be provision made for still something more in the way of savings profit, and all properly chargeable to the day's work? These are questions which call for accurate observation and computation.

Perhaps there is no one item connected with our economic life that would surprise us more than a knowledge of just what excess burdens the day's work actually carries.

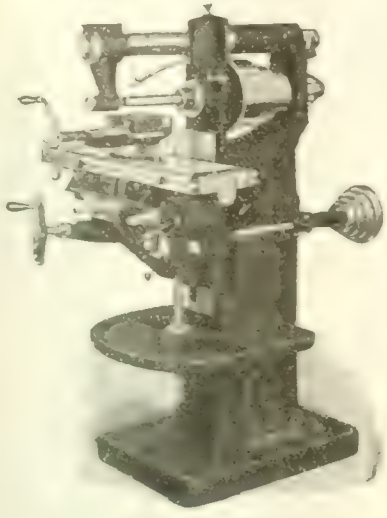
It carries all the worker's obligations outside the shop; it carries all that is necessary in the way of service and management inside the shop. The day's productive work is the most valuable mine of wealth that has ever been opened.

Certainly it cannot be made to carry less than all the worker's outside obligation. And certainly it ought to be made to take care of the worker's sunset days when labor is no longer possible to him, and should be no longer necessary. And if it is made to do these, industry will have to be adjusted to a schedule of production, distribution and reward which will stop the leaks toward the pockets of men who do not assist production in any way, and turn all streams for the benefit of those who do. In order to create a system which shall be as independent of the good-will of benevolent employers as of the ill-will of selfish ones, we shall have to find a basis in the actual facts of life itself.

It costs just as much physical strength to turn out a day's work when

MACHINE TOOLS

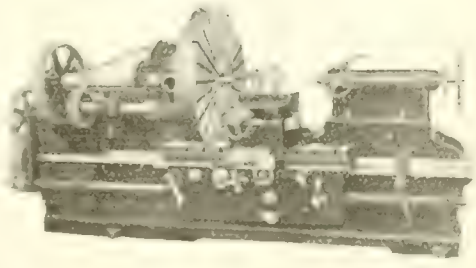
New or Used



We have an excellent list of new and used machine tools in our Toronto warehouses and on order for early shipment.

YOU are undoubtedly from time to time buying new equipment.

YOU will profit by giving us an opportunity of quoting you.



Garlock-Walker Machinery Company, Limited

32 Front St. West, Toronto

MONTREAL - - WINNIPEG

"Everything in Woodworking and Metalworking Machinery"

wheat is $1 a bushel, as when wheat is $2.50 a bushel. Eggs may be 12 cents a dozen or 90 cents a dozen—it makes no difference in the units of energy a man uses in a productive day's work.

One would think that the real basis of value would be the cost of transmuting human energy into articles of trade and commerce. But no; that most honest of all human activities is made subject to the speculative shrewdness of men who can produce false shortages of food and other commodities, and thus excite anxiety of demand in society.

It is not in industry that the trouble lies, but in those regions beyond, where men lie in wait to seize the fruits of industry and create false scarcities for the sake of arousing an anxious demand for things which normally are, and ought to be, accessible to all who engage in daily productive pursuits.

We must begin with the land; we must continue with the day's labor; and we must keep so close, so jealously close to both these fundamentals that we shall be suspicious and fearful of all that robs the land of men, and robs labor of its primal importance in material life.

We shall think out, and try out, and establish more enduring economic systems as we go on about our work, than we shall ever be able to do sitting idle with our heads in our hands trying to "think" a new world system out of our brains.

The day's work is the hub around which the whole wheel of earth-life swings. It must be kept central, both in our thinking and our action. Any system that shunts the day's work off to one side as unimportant, is riding to a fall.

U.S. SCRAP METAL

The coal strike effects are apparent in some districts, while others are untouched. Prices are higher in some cases. Following are reports from various centres:

CHICAGO.—Although a number of plants have had to close down, due to a shortage of coal, the scrap market remains strong. Foundry grades retain their strength and No. 1 wrought is a good feature. Railroad offerings amount to about 6,500 tons.

BOSTON.—There has been a general advance in the New England district, and the past month has been the best month for business of the year. Re-rolling rails have sold at $27 shipping point. Heavy melting steel will bring $17 if of good quality. Wrought pipe is at $18, and No. 1 machinery is $34.50 delivered.

NEW YORK.—There has not been much trading, but several grades have advanced. Heavy melting steel is at $18 to $18.50 f.o.b. New York. There is considerable buying by brokers, but not much selling.

PHILADELPHIA.—Heavy melting steel is strong in this district. Some heavy tonnages have been sold at $24.50 delivered, and one lot of 5,000 tons was sold at $22.50 delivered.

PITTSBURGH. — The coal shortage is affecting the market here. Several melters here have asked suspension of shipment against orders. This has had the effect of checking what was a strong upward market. Heavy melting steel is being quoted at $26 to $27 delivered.

BUFFALO.—Heavy melting steel is unobtainable in this market, although $23.50 has been offered. Dealers are holding on to their stocks and expect a further rise in this grade.

CLEVELAND.—The market here is weak, and not much change is expected till the New Year. Consumers are out of the market, and while prices are unchanged they are merely nominal.

CINCINNATI.—The coal shortage has resulted in the closing down of a number of steel mills. Dealers' stocks are increasing and the market is in consequence shewing signs of weakness.

ST. LOUIS.—Business is very light, the coal situation having had its effect, several consumers having asked suspension of orders. Prices are firm with advances in some cases. Heavy melting has advanced $1 to $22. Re-rolling rails have advanced $1 to $32. Cast scrap and malleable are in demand.

CIRCUIT BREAKERS DISCUSSED

The circuit breaker is a most important piece of apparatus in power plant design, and upon its successful functioning depends in large measure the size attainable in generating stations and their safe operation.

The rupturing capacity of an oil switch is one of the most important features of design with the rapid growth of power systems. Circuit breakers installed some years ago have been found to be totally inadequate in this important particular. The limitations of space as imposed upon the manufacture by the engineers in charge of station design often work to the detriment of successful breaker design, and it becomes necessary for the designer to make the breaker fit the job instead of being free to do what his best judgment dictates. A new type circuit breaker was described by G. A. Burnham, chief engineer of the Condit Electrical Mfg. Co., Boston, in a paper read before the Toronto Section of the A. T. E. E. at the Engineers' Club, on Friday evening, December 5. This breaker has been developed to take the place of other circuit breakers of a lower rupturing capacity and in design possesses some novel and interesting features. The structural design of the tank supporting parts has been very much strengthened and they are made of cast steel or malleable iron. They have been designed for a pressure of 40 pounds per sq. in. The tank is double and consists of an inner shell, which slides up inside a deep projecting lip on the top. The outer shell passes up around the outside of the lip, although only for a short distance, since it is some inches shorter than the inner one. On the occurrence of a severe short circuit or other disturbance, causing the breaker to trip open, the contacts separate in the usual manner and the pressure exerted by the ignition of oil vapors and by the arc itself is relieved by means of the spring suspension. The movement downwards of the tank, which is 1 1-16 in. for 40 pound pressure, also absorbs much of the shock on account of the inertia effect of the moving parts.

On the conclusion of the paper an animated discussion took place relative to the merits of the new device and related to circuit breaker troubles in general.

France Adopts Oil Fuel.—Trials have been made on an old locomotive on the leading French railway, with a view to ascertaining the possibility of burning oil instead of coal under the boilers. The trials have proved so successful that two hundred locomotives are being fitted with the burners for the new fuel immediately.

Electric Club Lunch.—The Electric Club held a most successful luncheon in the Mossop Hotel, Toronto. There were representatives of nearly every electrical company in the city present and the dining hall was not big enough to hold them. A very interesting address was given by T. W. Gordon, of the General Electric Company of Schenectady, on "Thrust Bearings."

HE'LL TELL THE WORLD

Williams in Indianapolis "News."

War Plant for Sale.—The munition plant of the Ker & Goodwin Company, of Brantford, which was just about completed at the time of the armistice, is being placed on the market. Negotiations for its purchase have been opened by the Brantford Cordage Co., according to a report from that city.

The death is announced from Sarnia of Malcolm McPherson, at the age of 72 years. Mr. McPherson was well known on the Great Lakes, where he sailed for many years. He was buried at the Union Cemetery, Mooretown.

Ottawa.—The "Canadian Recruit" was the last vessel to leave Montreal for the season of 1919 with a cargo. The "Canadian Planter" is still at Vickers' yard, but will be completed and sent down to Quebec to be loaded. The Elder-Dempster liner "Bassa" is still ashore, and the work of lightening her is proceeding. Fear is entertained that she may be compelled to remain in the river all winter if not speedily floated.

Sarnia.—Released from a bar where she had gone ashore a day or two previously, the tug Annie Moiles turned over and sank. Six men were aboard of her when she turned over, but all made their escape in safety. The tug went ashore while towing the scow Ontario.

Vancouver.—The first of the four steamers being built in the Coughlan yard for the Canadian Merchant Marine was launched successfully. She is a vessel of 8,100 tons, and was christened the "Canadian Importer." The sponsor was Mrs. Cooper, the wife of the Federal member for South Vancouver. She will be the first vessel of the Canadian Merchant Marine to take the regular sailings for Australia.

Wrecking at Leaside.—The work of demolishing the tool house at the Leaside ammunition plant, the property of the United States Government, is being rapidly proceeded with. The building, which has a frontage of 40 feet by 120 feet in depth, is being sold piecemeal as fast as it is pulled down. The Leaside town council are in communication with the Federal Government with a view to saving the main building, which cost $3,000,000 to build.

The Richardson-Phenix Company, Milwaukee, have again opened their Philadelphia office and placed it in the charge of Mr. Geo. F. Fenno. Mr. Fenno has been associated with the Richardson-Phenix Co. for ten years and has recently been released from the Government service, where he was in charge of the conservation of lubricants for the department of military aeronautics.

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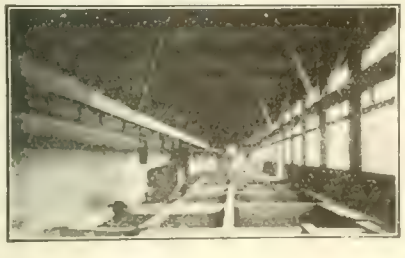

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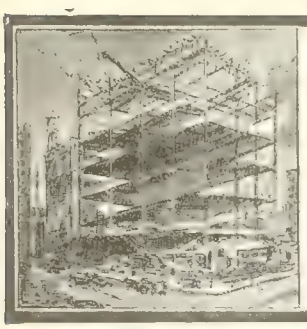

INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES

TRADE GOSSIP

Lignite Plant in Manitoba.—A plant for the manufacture of lignite fuel will be erected in the spring near Bienfait, Man., on the C.P.R. This was announced by J. M. Leamay, Provincial Commissioner. The buildings will all be of steel.

C.N.R. Confiscates Coal.—St. John, N.B., coal dealers are having their stocks cut down by confiscation by the Canadian National Railways. The railway has power under an order-in-council to take what coal they require and pay the dealer the mine price.

Privy Council Awards Share.—The proceeds of the sale of the steamer "Storstad," which sunk the Empress of Ireland, will be shared by the C.P.R. The Canadian Supreme Court gave the preference to the passengers, but the Privy Council reversed the decision.

Start New Bridge.—Work on the construction of the new bridge over the Niagara River will commence this month. Representatives of the Canadian Niagara Bridge Company have arrived at Black Creek, six miles from Bridgeburg, and will start work preparing for the abutments as soon as the necessary machinery arrives.

Mechanics Go To States.—The officials of the Metal Trades and Building Trades Unions are seriously worried by the growing shortage of men, due to so many of them going across the border. A good many men who went there during the strike here have failed to return. More are going now, being attracted by the high rate of wages.

Canada Iron Foundries' Report.—The Canada Iron Foundries' report shows the effect of making the readjustment from war-time to peace conditions. The earnings for the year ending September 30 show a decrease from those of last year. They were $489,943, compared to $580,824 in 1918. An additional sum of $99,098 was secured from interest discount and exchange which brought the total to $595,908.

Clergyman on Conciliation Board.—The appointment of the Rev. Clarence McKinnon to the Board of Conciliation dealing with the dispute between the Dominion Coal Company and its employees at Glace Bay, is the first instance of a clergyman acting on a board under the Lemieux Act. Mr. McKinnon will act as chairman of the board, J. C. Watters will represent the employees, and Col. W. E. Thompson the coal owners.

Toronto Engineering Institute.—An interesting lecture on sound ranging of heavy artillery in France was given by Captain Roy Cockburn at a recent meeting of the Institute at the Engineers' Club. The election of officers was also held, the result being as follows: Chairman R. O. Wynne Roberts; Committee men: Geo. T. Clarke T. Taylor, Prof. C. R. Young and J. C. Krum.

Will Stop Export.—An official of the Canadian Railway Board speaking recently said that even if the coal strike was settled there was little chance of any coal reaching Canada during December. Railways are already using wood fuel for their stationary boilers, and have reduced their passenger service, and there is no doubt that a serious curtailment of freight trains will ensue.

Big Convention for Toronto.—The next convention of the International Machinists' Association will be held in Toronto, in all probability. The date fixed is September, and about 3,000 delegates will attend. The convention will last about three weeks, and business to the amount of $400,000 will accrue to the city if Toronto's invitation is accepted. Acceptance depends on the ability of the city to accommodate the delegates.

Secure Contract. — The MacKinnon Steel Co., Ltd., of Sherbrooke, Que., has been awarded the contract for the steel superstructure of the highway bridge which the Government of the Province of Quebec has arranged to erect over the Batiscan River at Batiscan, Que., on the Montreal-Quebec highway. This bridge, which is over twelve hundred feet long, will be one of the largest highway bridges in the Province of Quebec.

$1,000,000 Arena For Montreal.—An arena with seating capacity for 6,000, and standing room for 6,000 more, will be built and ready for hockey on January 15th next. The location will be near Windsor and Dorchester street. The building will include a garage. The capital will be $2,000,000, the shares being of $10 each, so that opportunity will be given to all sport lovers to subscribe.

Hamilton as an Ocean Port.—An association known as the Canadian Deep Waterways and Power Association, has been formed. The object of the association is the promoting of the shipping interest of the ports, and important developments are expected from their activities. The Board of Control of Hamilton are considering a request for a contribution to the funds of the association. Plans for the development of the Hamilton waterfront are nearly ready for presentation to the Board of Control.

Antimony Mine Plant.—The North American Antimony & Smelting Company, a new company with a capitalization of $2,000,000, organized for the developing of the antimony mines of Lake George, York County, N.B., has ordered its machinery. The machinery ordered at present consists of boilers and engine, and preparations are being made for the installation of the concentrating plant.

To Boom Municipalities.—An industrial conference will be held next summer, the object of which will be to bring the power facilities of the Niagara district prominently before the world. This was decided on at a meeting of the municipal representatives from all parts of the Niagara district held at Welland recently. The towns concerned are St. Catharines, Welland, Thorold, Niagara Falls, Bridgeburg, Port Colborne, Fort Erie, Stamford, Merritton and Crowland Townships.

MARINE

St. John, N.B.—The new dry dock which is being built at Courtenay Bay, St. John harbor, will be, when completed, the largest dry-dock in the world. It will take two and a half years to complete.

New York.—The "Imperator," the huge ex-German liner, will make her first voyage under the British flag this week. She will carry 600 first, 400 second, and 1,500 third cabin passengers. She will receive sufficient bunker coal for the voyage to England.

Ottawa.—Recommendations for improvements to Vancouver harbor, presented to Mr. Ballantyne, include a modern 1,300-foot wharf on Burrard Inlet, a car ferry service between Vancouver and North Vancouver, and a terminal railway system. The improvements would run into several million dollars.

Port Arthur.—A wireless was received from the steamer "Collingwood" that she had been forced to go for shelter behind Kewwanaw Point. A severe storm was raging on Lake Superior and several other boats were also seeking shelter at the same time. The weather at the time was quite fine at Port Arthur.

Sault Ste. Marie.—There were several big freighters caught in the ice in Mud Lake recently, a most unusual occurrence for the time of the year. Mud Lake is just below Sault Ste. Marie. The vessels were the "Martian," "W. Grant Morden," "Odanah" and "Midland King." A tug was necessary before they could be released.

Ottawa.—The Government have now received and commissioned eighteen of their fleet, and they will have before the

SURPLUS EQUIPMENT FOR SALE

PRESSES

	Stroke Inches	Width Bed	Approx. Cap. Tons
2—No. 666 Toledo Embossing Presses....	2	32	1,200
2—No. 27 Bliss Embossing Presses	2	32	1,000
2—No. 87 Bliss Crank Presses, double back geared	16	27	250
2—No. 60½ Bliss Rack and Pinion Drawing Presses	60	21	100
10—No. 60½ Bliss Rack and Pinion Drawing Presses	42	21	100
1—No. 857 Toledo Rack and Pinion Drawing Press	48	25	100
1—Robertson Hydraulic Press with pump and extra set of columns.....	24	27	800

LATHES

7—11" Blount Speed Lathes, 5' bed.
1—18" Hamilton Lathe, 6' bed.
1—19" Greaves & Clushman Lathe, 8' bed.
2—18" Davis Lathe, 6' bed.
1—15" Carroll Jamieson Lathe, 6' bed.
1—16" Davis Lathe, 6' bed with Turret.
1—16" Hamilton Lathe, 6' bed.
5—16" Blount Speed Lathes, 6' bed.
4—No. 2 Warner & Swasey Speed Lathes.
2—20" Stoll Wood Turning Lathes.
35—Bullard Cartridge Case Lathes.

GRINDERS

2—Wells Cutter Grinders.
1—12" x 72" No. 4 Cincinnati Universal Grinder.
1—No. 70 Heald Internal Grinder.
1—No. 75 Heald Internal Grinder.
1—10" x 24" Landis Grinder.
1—No. 1 American Surface Grinder.
1—No. 74 La Salle Surface Grinder.
1—Ford-Smith Double Head Grinder, 3" x 24" wheel.

FURNACES

1 Gas Muffle Furnace, 3¼ x 1½" x 7" long.
1—Gas Tempering Furnace with oil reservoir.
1—Gas Tempering Furnace with Tray in Reservoir.
1—H.S. Tool Hardening Furnace, 9" x 8" x 9" long.
1—Double Door Gas Furnace, Doors 20½" x 12" high. Fire Space 50" wide, 12" high, 54" long.
1—Gas Furnace for Annealing Scrap Brass.
5—26 ft. Rockwell Single Chamber Annealing Furnaces, equipped with Electric Pyrometers and Recording Instruments, Oil and Gas Burners, Air Rams and Pullers.
1—16 ft. Rockwell Single Chamber Annealing Furnace equipped with Electric Pyrometers and Recording Instruments, Oil and Gas Burners, Air Rams and Pullers.
3—Conveyor Type Annealing Furnaces. Could be used for annealing automobile pistons or other similar work.

BLOWERS AND FANS

	Size of Outlet		Displacement per rev.
1—Root Positive Blower	8"	Vertical	3.3 cu. ft.
2—Connersville Positive Blower....	8"	"	3.3 " "
2— " " "	6"	"	1.5 " "
1— " " "	6"	Horizontal	1.5 " "
1— " " "	8"	"	1.5 " "
1—No. 4 Sheldon Blower.....	9"	"	
2—No. 4 " "	9"	Vertical	
1—No. 4 Sturtevant "	10"	Horizontal	
1—Boland Positive Blower	4"	"	
3—Desk Fans.			

MOTORS

10 to 75 H.P., 25 and 60 cycle, 220 Volt., 3-phase.

MISCELLANEOUS

DRILLS

1—3 Spindle Variable Speed Drill. C. G. Allan Co., Barrie, Mass.

SHEARS

1—No. 1 Gray's Sheet Metal Cutter.
1—No. 1 Quickwork Rotary Shear.

HACKSAWS

1—No. 3 Atkins Power Hacksaw.

MILLING MACHINES

1—No. 1 Standard Hand Miller.
11—No. 3 Brown-Boggs Trimming Machines.
1—No. 066 Deming Gear Oil Pump, Belt Drive.
2—Franklin Portable Cranes.
12—Cowan Elevating Trucks.
2—20-lb. Cap. Scales Drams Graduation on Beam.
1—Two-Ton Platform Scale.
1—Five-Ton " "
2—½-Ton " "
2—1,200-lb. " "
1—Tinius Olsen Testing Machine, 10,000 lbs. capacity, hand-operated.
1—No. 1 Brinell Hydraulic Testing Machine.
1—Sauveur-Boylston Photo-Micrographic Instrument.
23—4" Curtis Air Hoists.
2—5" " " "
1—6" " " "
26—I-Beams for Curtis Air Hoists.
1—Boland Special Sand Blast Machine.
1—No. 2X Garvin Vertical Tapping Machine.
1—Whitton Centering Machine.
Dodge Wood Split Pulleys.
Cast Iron Split Pulleys.
Shafting, and Hangers.
1—Model "M" Richardson Force Feed Oil Pump.
3—No. 310 Simplex Lifting Jacks.
4—2½" x 18" Screw Jacks.
1—2¼" x 16" " "
3—1¼" x 4" " "
1—No. 873 Toledo Trimming Machine.
Bristol & Brown Indicating Pyromters.
" " Recording "
3 Shore Scleroscopes.
1—C. E. Wright Metal Cutting Handsaw, 30" Wheels.
1—No. 35 Demagnetizer Style, 115 D.C., Amps. 1.5, Volts 115. Made by D. & W. Fuse Co., Providence, R.I.
5—Heads Suitable for Polishing Brushes, 1¾" Hole in chuck, 1" spindle.
1—Bench Tapping Machine, takes up to ⅜" tap. Burke Machine Company, Conneaut, Ohio.
1—Carboy of Cement Hardening, 5 Gals.
1—Thor 1—1/16" x 4" serial D.R.H. Air Hammer.
1—Ingersoll Rand, size 1 S, symbol 1 SM Air Hammer.
1—Ford Car Starter.
2—Automatic Receivers for Boiler House Feed Pumps.
1—Tank, 30" dia. x 48" long, suitable for Compressed Air.
1—Tank, 24" dia. x 60" " " " " "
1—Tank, 36" dia. x 72" " " " " "
1—Open Galv. Iron Tank, 5 ft. high x 3 ft. dia. with 1" faucet.
4—¼" Thick Iron Open Tanks, 4 ft. long, 2 ft. wide x 1 ft. 8 in. deep with 2 in. drain.
1—Motor-driven addressograph machine with stencil cutting machine and full equipment of special attachments.
2—Adding Machines (Listing)

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WHEN WRITING ADVERTISERS KINDLY MENTION THIS PAPER

end of the year twenty-two in active service. The "Canadian Aviator," built in Vancouver, will shortly leave for Australia with a cargo of paper, and the "Canadian Volunteer" and "Canadian Trooper" have sailed for Great Britain by way of the Panama Canal.

Ottawa.—The two ships recently ordered from the Wallace Shipbuilding Co. in Vancouver, bring the Dominion Government fleet up to fifty-seven ships. There are about 20,000 men employed in the various yards of the country and there are about the same number employed in the contributory trades. Canada has an investment of $47,000,000 in her shipyards. The two latest vessels are of 8,350 tons.

New York.—The people of the Eastern states are not feeling very kindly towards the move to deepen the St. Lawrence canals and open up the lake ports to ocean navigation. They are of the opinion that such a move would be to the detriment of the Atlantic ports of the U.S. and a benefit to Canada only. This is not in accordance with their wishes, and they will oppose strenuously any participation by the United States Government.

Masters, Mates and Pilots.—The National Association of Masters, Mates and Pilots have joined the Trades and Labor Council. The National Association, which was organized in the States last March, has now eighty-nine harbors, or as they would be called ashore, locals. Montreal, Kingston, Quebec and Toronto have harbors, and many more will be formed shortly. Capt. W. Stitt is president of Toronto Harbor No. 68. Capt. John Strain, of Buffalo, is business manager of the organization.

PERSONAL

Mr. W. Wheatley, lately elected president of the Armstrong-Whitworth Company of Canada, sailed from Liverpool, Eng., recently on the steamer "Lapland" for Montreal. He will start his new duties in the course of a few weeks, after paying a visit to his native town of Lima, Ohio.

Mr. William Worthington, head of the Sewers Branch of the Toronto Works Department, has tendered his resignation to take effect on December 15. Mr. Worthington will go into private practice as a consulting engineer, after eighteen years spent in the service of the city. This is the fourth of Toronto's department heads to resign recently.

INCORPORATIONS

Incorporation of a $10,000,000 company for Montreal, and of a number of other companies of large capitalization have been gazetted. The principals are: The Oakcoal Company of Canada, Limited, Toronto, capital $1,250,000; Gear Produce of Canada, Limited, St. Catharines, Ont., capitay, $250,000; Librairie Garneau, Limited, Quebec, capital $250,000; Tremblay & Dufour, Limited, Chicoutimi, capital $50,000; Ottawa Farm Journal, Limited, Ottawa, capital $200,000; Trans-Canada Theatre, Limited,

Montreal, capital $3,750,000; Western Wheel & Foundries, Limited, St. Boniface, Manitoba, capital $2,000,000; Simmons, Limited, Montreal, capital $10,000,000; Canadian Nathan, Limited, Montreal, capital $100,000; Canadian MacArthur Concrete Pile Company Limited, Montreal, capital $24,000; Charles E. Goad Engineering Company, Limited, Toronto, capital $300,000; MacPherson Wire Company, Limited, Hamilton, capital $400,000; Canadian Inspection & Testing Co., Limited, Toronto, capital $40,000; Edgar Allan & Co., of Canada, Limited, Montreal, capital $50,000; Ellsey Dress Manufacturing Company, Limited, Toronto, capital $150,000.

CATALOGUES

The Jeffrey Manufacturing Company, Montreal, P.Q., have issued Bulletin No. 273 which supplements Catalogue No. 244. A line of 10 in. bucket elevators has been added, also chains having reversible steel bushings. A page is given to each Standard Elevator, which is illustrated both in perspective and in line drawing, giving dimensions. Also on each page there is an illustration showing the chain and bucket used on that type of elevator. Below the illustrations are the specifications from which you can easily select the elevator for your needs.

OBITUARY

The death is announced from Brockville of Mr. Sidney Arthur Logan. Mr. Logan had been a resident of the town for 41 years and was a well-known contractor. He was born in Elma, Dundas County, in 1846, his parents being pioneers of that community. He went to Brockville in 1878, and engaged in sewer and waterworks construction.

PIG IRON TRADE

The price of pig iron of all grades is going steadily upwards. In an already strong market, the prospect of curtailment by lack of coal acted as a further strengthener. Following are reports from various U. S. centres:

PITTSBURGH.—The foundry iron market has been quiet lately, but this is due to the furnaces being pretty well booked up for next year, first half. There has been great activity in basic, 40,000 tons of this grade having been sold. The basic prices are $33 valley and Bessemer at $34.

NEW YORK.—The demand for pig iron is strong, and furnaces have sold up at least half their capacity for the first half. This condition is reflected in the rising prices. Eastern Pennsylvania foundry, 2.25 to 2.75 silicon, first half delivery, has sold at $37 and $38 furnace, and 2.75 to 3.25 silicon at $39 to $41 furnace.

BUFFALO.—The three grades of foundry as well as malleable and basic have advanced in price. No. 2 foundry is now $38. Basic is quoted at $36 and malleable at $39.25. Consumers from outside the district have come into this market for iron.

CLEVELAND.—Heavy demand, far exceeding the available supply, characterized the market, resulting in further advances. High silicon iron was sold for $36 for the base grade. Basic has sold for $33 valley furnace. Coal supply is getting very low, and may interfere with production shortly.

CHICAGO.—Producers are practically out of the market, thus applying to both Northern and Southern furnaces. Melters would be glad to place contracts almost regardless of cost. A small tonnage from a Virginia furnace is being offered in the Chicago district at $36 furnace, with a $5 freight rate, and full manganese differentials.

CINCINNATI.—There is not much iron available in Southern Ohio, and the quotation for 1.75 to 2.25 silicon for first quarter delivery is $35 Birmingham. Malleable is in good demand with only a limited quantity to be had.

BIRMINGHAM.—Enquiry is good, and production is not up to normal. Foundry iron No. 2 grade is selling at $35 in one case but generally at $33 to $34. The probability of advanced wages to coal miners is making producers cautious, as this would increase their costs.

PHILADELPHIA.—There is general anxiety on the part of consumers to buy iron, the effects of the coal strike being in evidence already. There are several enquiries for lots of 15,000 for first half. Makers are mostly out of the market, having booked up 50 to 70 per cent. of their first half capacity. Malleable has sold at $37 Eastern Pennsylvania furnace for first half delivery, and basic at $35 Eastern Pennsylvania furnace.

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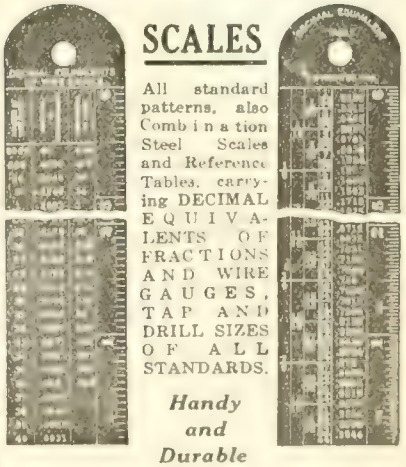
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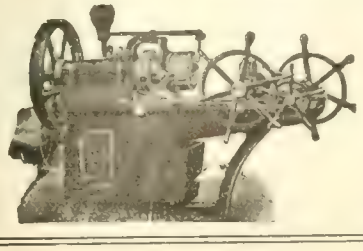
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"National" Bolt Cutters, "Wedge Grip" Bolt and Rivet Headers, Forging Machines, Nut Machines, Roll Threaders and Wire Nail Machines are used by leading Railroads and Industrials.
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POSITION WANTED BY A FIRST-CLASS mechanic with a large experience in making gauges, dies, jigs and fixtures for small work, and small tools; can take charge of department. Know how to handle screws; have been working in some of the best shops in the U.S. Is an inventor, also improver and designer. Aged 50 years; good health; steady worker. In answering please mention the class of work and mention the highest wages, with all particulars. A position wanted for his son, also a first-class mechanic. Apply during the week of November 15th. L.E.J., 38 Glenelg Street W., Lindsay, Ont. (c26m)

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BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 39 George St., Brantford, Ont. (ctfm)

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Alley & McLellan Air Compressor 600 ft. at 100 lbs. pressure, 125 H.P. Motor, heavy duty 600 R.P.M. 3 phase 60 cycle 550 volts.
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No. 4 B & S. Plain Miller
1—36" x 36" x 8' Gray Planer, two heads
No. 3—Cincinnati Universal Miller
5—No. 0 Steptoe Hand Millers
13" x 5' 6" New Carroll-Jamieson Quick-Change Lathe
14" x 6' New Carroll-Jamieson Quick-Change Lathe
15" x 6' New Sidney D.B.G. Quick-Change Lathe, swing 17"
15" x 8' New Sidney D.B.G. Quick-Change Lathe, swing 17"
17" x 8' New National Quick-Change Lathe
3—17" x 8' New Sidney D.B.G. Quick-Change Lathe, swing 19"
17" x 10' New Sidney D.B.G. Quick-Change Lathe, swing 19"
18" x 24" New Rahn Larmon Lathe, D.B.G. Quick-Change
19" x 10' New Sidney D.B.G. Quick-Change Lathe, swing 21"
9—19" x 8' New Sidney D.B.G. Quick-Change Lathe, swing 21"
25" x 14' New Sidney D.B.C. Quick-Change Lathe, swing 27"
33" x 14' Putnam, arranged for Motor Drive
6' Western Radial Drill
5' Bickford Single Pulley Drive Radial
100-lb. New Little Giant Hammer
50-lb. New Little Giant Belt Hammer
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30-ton Watson & Stillman Hydraulic Press

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International Machinery and Supply Company, Limited
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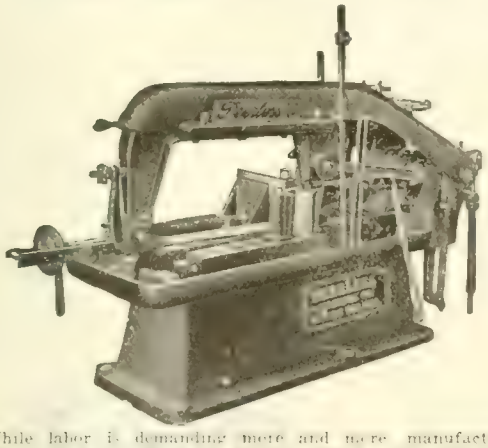
Peerless HIGH SPEED

Thedard Metal Saw of TO-DAY



While labor is demanding more and more manufacturers are demanding machines of greater output. The "Peerless" meets that demand. It is the standard metal saw of TO-DAY.

With its rapid cut and various time-saving features, it easily increases production from 50 to 100 per cent. With its automatic feed, straight line pull, positive blade clamp and general rigidity, it gets the maximum results of which a blade is capable and reduces breakage to a minimum.

OUR SIX-SPEED GEA BOX

(not shown in cut) further increases output and saves blades wherever soft steel or metals of varying degrees of hardness have to be cut. The "Peerless" is furnished either with or without this feature, also with or without motor.

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MACGOVERN & COMPANY ENGINEERS CRATERS POWER MACHINERY

HORIZONTAL RETURN TUBULAR BOILERS

Qty.	Size	H.P.	Make	Pressure
1	60" x 14'	70		80 lbs.
1	66" x 14'	70	JOHN INGLIS	85 lbs.
1	66" x 16'	85	GOLDIE & McCULLOCH	120 lbs.
1	66" x 16'	100	GOLDIE & McCULLOCH	100 lbs.
1	72" x 16'	100		70 lbs.
1	60" x 14'	100		85-100 lbs.
2	66" x 15'	100		
2	66" x 16'	100	MURRAY IRON WORKS	125 lbs.
1	72" x 18'	125	STEWART	100 lbs.
1	72" x 14'	125	GOLDIE & McCULLOCH	85-100
1	72" x 18'	125	DILLON	125 lbs.
4	72" x 16'	135		80-100 lbs.
1	72" x 18'	150		100 lbs.
1	72" x 18'	150	BROWNELL	100 lbs.
1	72" x 18'	150		180 lbs.
1	72" x 18'	150	STEWART	100 lbs.
4	72" x 18'	150	KELLER	125 lbs.
1	72" x 18'	150	ROBB MUMFORD	85-100
1	72" x 18'	150	UNIFLOW	125 lbs.
2	72" x 18'	150	KELLER	105 lbs.

WATER TUBE BOILERS

Qty.	H.P.	Make	H	P
1	100	BABCOCK & WILCOX		125 lbs.
	125	HEINE		125 lbs.
2	150	ROBB ENGINEERING		155 lbs.
2	204	BABCOCK & WILCOX		160 lbs.
	272	BABCOCK & WILCOX		
		HEINE		
1	250	CAN. FOUNDRY		160 lbs.
8	250	STERLING		
4	250	STERLING		150 lbs.
6	264	BABCOCK & WILCOX		
	400	CANADA FOUNDRY		
3	408	HEINE		
	428	BABCOCK & WILCOX		125 lbs.
3	450	BABCOCK & WILCOX		
1	450	HEINE		
	500	HEINE		
	500	ERIE		
	600	STERLING		
4	650	HEINE		180 lbs.
1	800	HEINE		
2	850	ROBB		175 lbs.
1		BABCOCK & WILCOX		160 lbs.
1	700	GOLDIE & McCULLOCH		
4	502	BABCOCK & WILCOX		200 lbs.
2	625	BABCOCK & WILCOX		200 lbs.
1	750	ELLIOTT		150
3	300	STERLING		225 lbs.

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The foreman says.

"I suppose it's because I used them myself when I was at the bench, but it does seem as though the best men in the shop have a preference for Starrett Tools.

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"Yes, I bought one of each of the books down at the hardware store, as soon as they came out. They cost me seventy-five cents each, but they're worth it."

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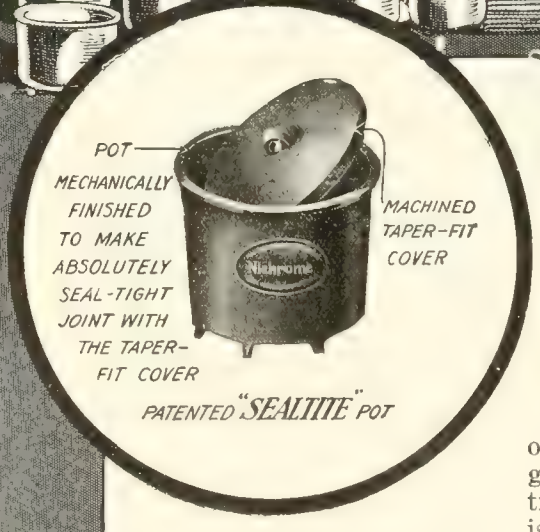
If interested tear out this page and place with letters to be answered.


POT MECHANICALLY FINISHED TO MAKE ABSOLUTELY SEAL-TIGHT JOINT WITH THE TAPER-FIT COVER
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Nichrome
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Nichrome Castings

for Heat Treatment

Cast Nichrome may be machined without great difficulty. With the machined gas sealing cover, furnished with the "Sealtite" pot as shown in the figure, no fire-clay is required for sealing the cover, and the heat treatment penetration shows a large percentage increase over that of iron and steel pots.

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The taper-fit gas seal of the patented "Sealtite" pot lasts as long as the pot is serviceable. The gases necessary for carbonizing are confined within the container and it has been shown that an increasing depth of case results from the increased gas pressure.

A considerable saving in time and carbonaceous compound has been obtained by some users of the "Sealtite" pot.

Write for further particulars.

Manufactured under Henderson patents.

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25

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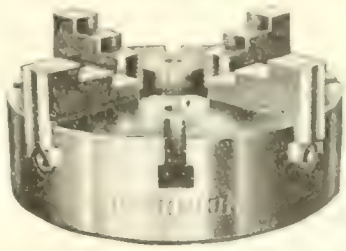

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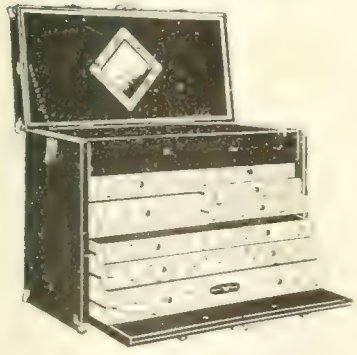
"Machinists Tools" Make Useful Christmas Presents

We have in stock for immediate shipment the highest grade Bar Iron, Black and Galvanized Sheet Iron, Machine Steel, Cast Steel, High Speed Steel, Cold Rolled Steel, etc.

Machinist's Tool Chests



Time and again skilled machinists have remarked on the strength of construction and compact design of our Tool Chests. Have us give you full particulars.

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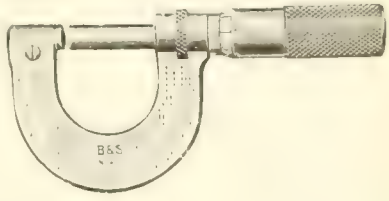
Clinch beneath the surface of the belt on the pulley side the part in contact with the pulley. They maintain uniform grip the entire width of belt and lower wheel from wear.

Micrometer and other fine tools



Select from such wholly dependable makes as Starrett or Brown & Sharpe, or from other makes you have proven in your own shop to be most durable and efficient. Our stocks are complete.

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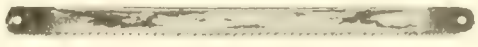

Durable, fast-cutting blades that you can rely upon to cut true through toughest metals. Users have found that these blades increase every day's output and serve much longer than ordinary blades.

Write us about your requirements.

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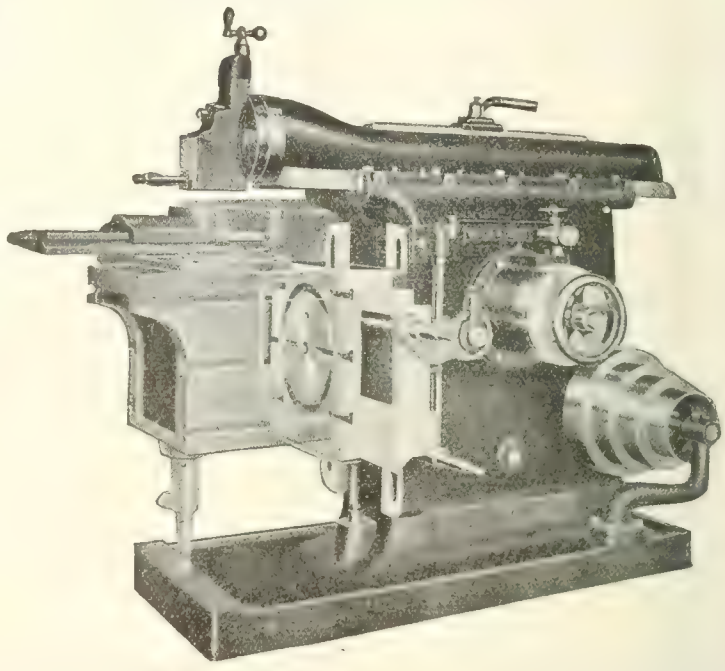
Are needed in Up-to-date Canadian Shops

Milwaukee simplicity, power and accuracy play an important part in turning overhead expense into profitable production.

Milwaukee Back Geared Crank Shapers are built in 16-inch, 20-inch and 24-inch sizes.



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By Sir Robert Falconer, President of the University of Toronto

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The article gives the opinions on this vital topic of such men as: Sir Robert Falconer; Principal R. Bruce Taylor, of Queen's; Dean of Arts W. Sherwood Fox, of Western University; A. P. S. Glassco, Secretary of McGill; President MacLean, of the University of Manitoba; President Klinck, of Canada's youngest university—British Columbia; President A. Stanley Mackenzie, of Dalhousie; and many others.

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By Basil King

This famous Canadian novelist has written a remarkable story that deals with a man who loses his identity while fighting in France. This strong novel, "The Thread of Flame," starts in the December issue of MACLEAN'S. This is the first occasion that a novel by Mr. King has appeared in any Canadian periodical prior to book publication.

Other Features of the December Number

"Merrie Gentlemen"—By Arthur Beverley Baxter.
You will think this the best Christmas story since Dickens' "A Christmas Carol."

"Capital and Labor"—By Ralph Connor.
One of a series of articles on "The New Canada and Its Needs."

"Ottawa is Ready for the Worst"—By J. K. Munro.
A humorous and pithy review of events at the Federal seat.

"Better Late Than Never"—By C. W. Stephens.
A bright Christmas story.

"Some Canadian Snobs"—By Montgomery Dix.
A humorous article on some phases of Canadian society.

"A Blighty Christmas"—By Gertrude Arnold.
An article on the way Yuletide was celebrated in a Red Cross Hospital.
And a dozen other articles and stories all of equal interest.

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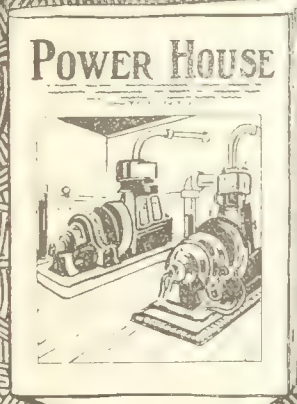

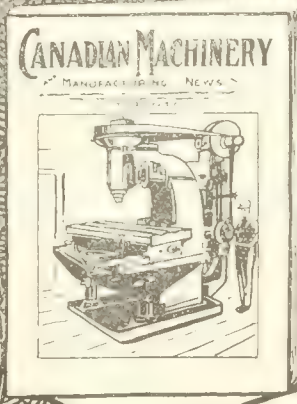

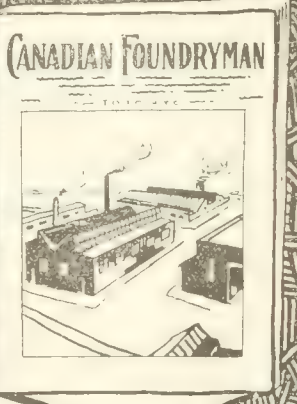

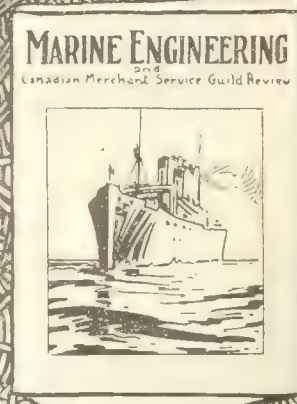

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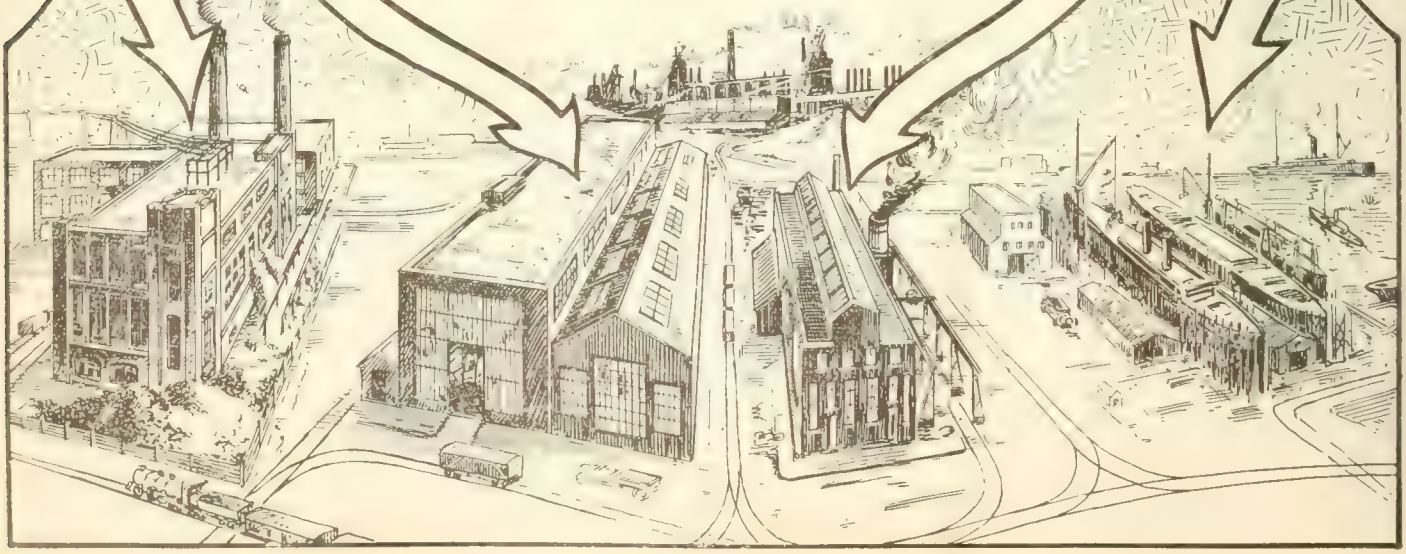

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Brantford Wheels for Durability and Efficiency

Remember this when you are considering an order for Emery Wheels. We sell direct to the user—you save the middleman's profit. Then you can depend upon our wheels giving the most efficient service—our wheels represent highest quality in raw materials and manufacture.

Give them a trial.

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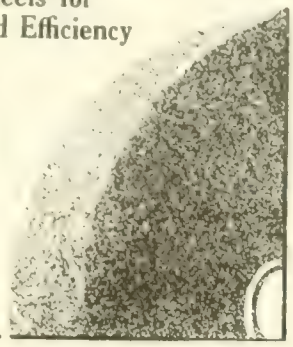

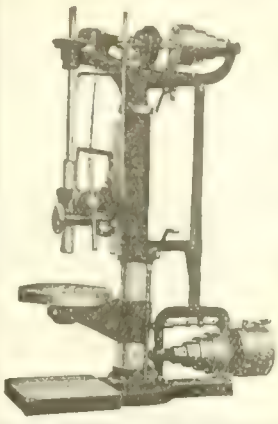

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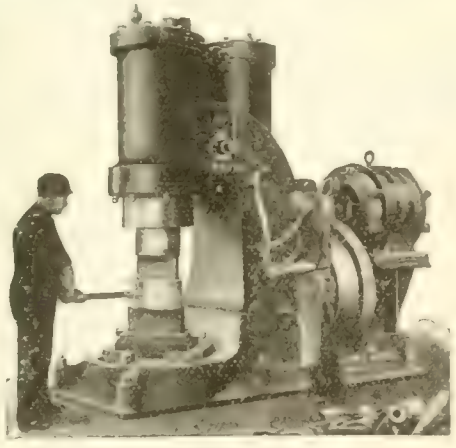

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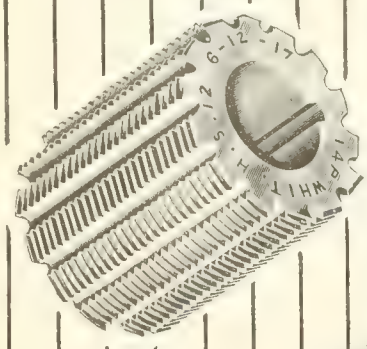

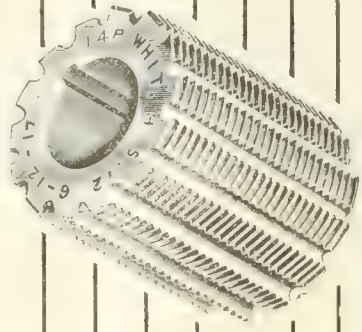

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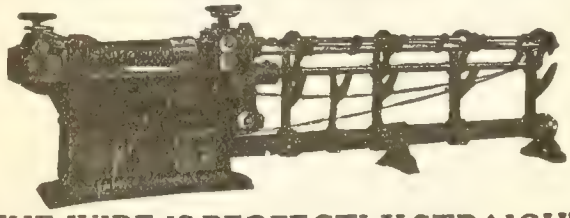

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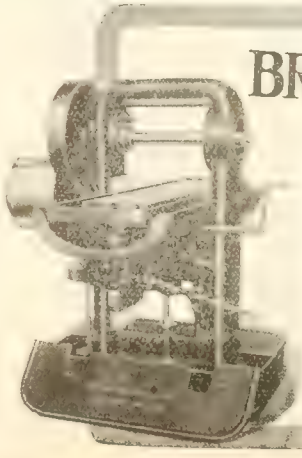

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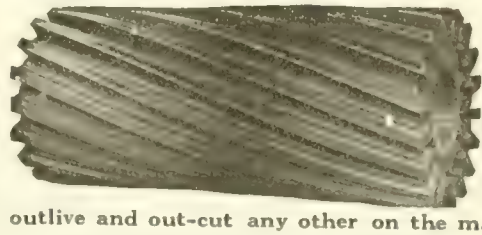

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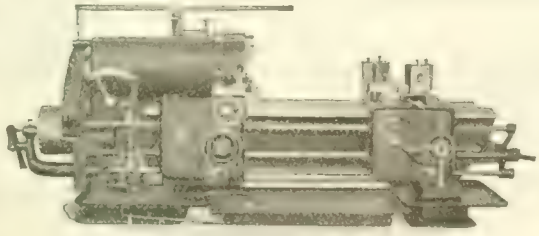

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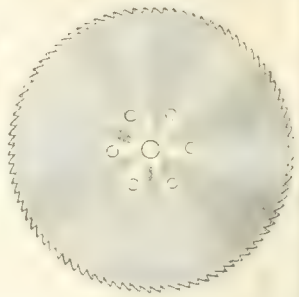

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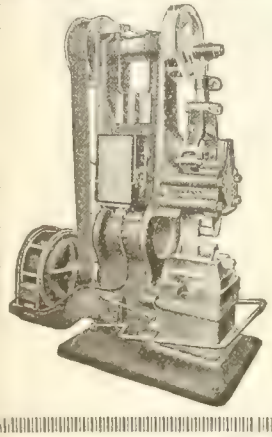

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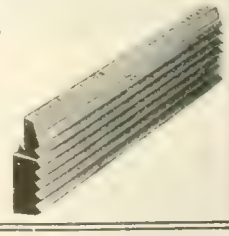

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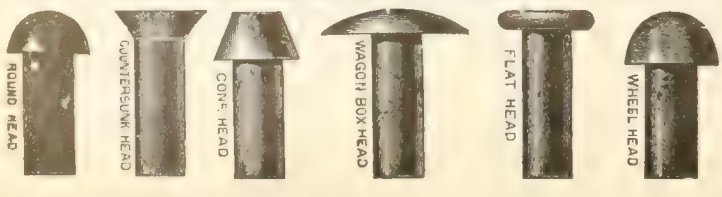

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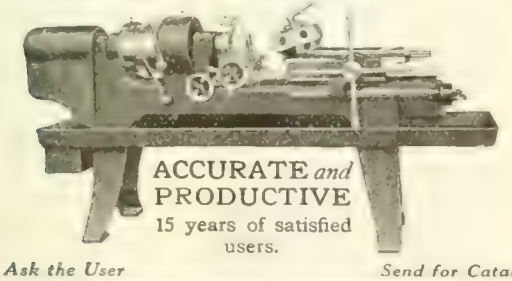

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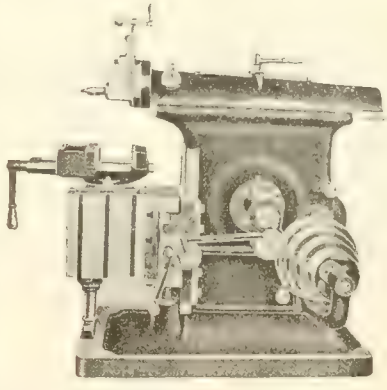

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Smalley-General Co., Inc., Bay City, Mich.
Williams & Wilson, Ltd., Montreal, Que.

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Bicknell-Thomas Co., Greenfield, Mass.
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Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
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Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Machy Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
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Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Whiton Machine Co., D. E., New London, Conn.
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Whitney Mfg. Co., Hartford, Conn.

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Victor Tool Co., Waynesboro, Pa

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Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass
Williams & Wilson, Ltd., Montreal, Que.

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Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

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National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York
Roelofson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach. Co., Brazil, Ind.
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CLEANING COMPOUND
Oakley Chemical Co., New York.

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Gisholt Machine Co., Madison, Wis.
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Wright Mfg. Co., Lisbon, Ohio.

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Carlyle Johnson Mach Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Williams & Wilson, Ltd., Montreal, Que.

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Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Williams & Wilson, Limited, Montreal.
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

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Wilson & Co., J. C., Belleville, Ont.
Williams & Co., J. H., Brooklyn, N.Y.
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J. C. Wilson & Co., Belleville, Ont.

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Hardinge Bros., Inc., Chicago, Ill.
Wilson & Co., J. C. Belleville, Ont.

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Canada Metal Co., Toronto, Ont.

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Oakley Chemical Co., New York, N.Y.

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Lynd-Farquhar Co., Boston, Mass.

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Cleveland Pneumatic Tool Co., Toronto.
Curtis Pneumatic Machy. Co., St. Louis
Elliott & Whitehall, Galt, Ont.
Garlock-Walker Machy. Co., Toronto.
Hinckley Machine Co., Hinckley, Ill.
MacGovern & Co., Montreal, Que.
Williams & Wilson, Ltd., Montreal, Que

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Smalley-General Co., Inc., Bay City, Mich.

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Blanchs Co., L. C., New York City.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg Co., Akron, O.

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Brown & Sharpe Mfg. Co., Providence, R.I.
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Foster Machine Co., Elkhart, Ind.
Williams & Wilson, Ltd., Montreal, Que.

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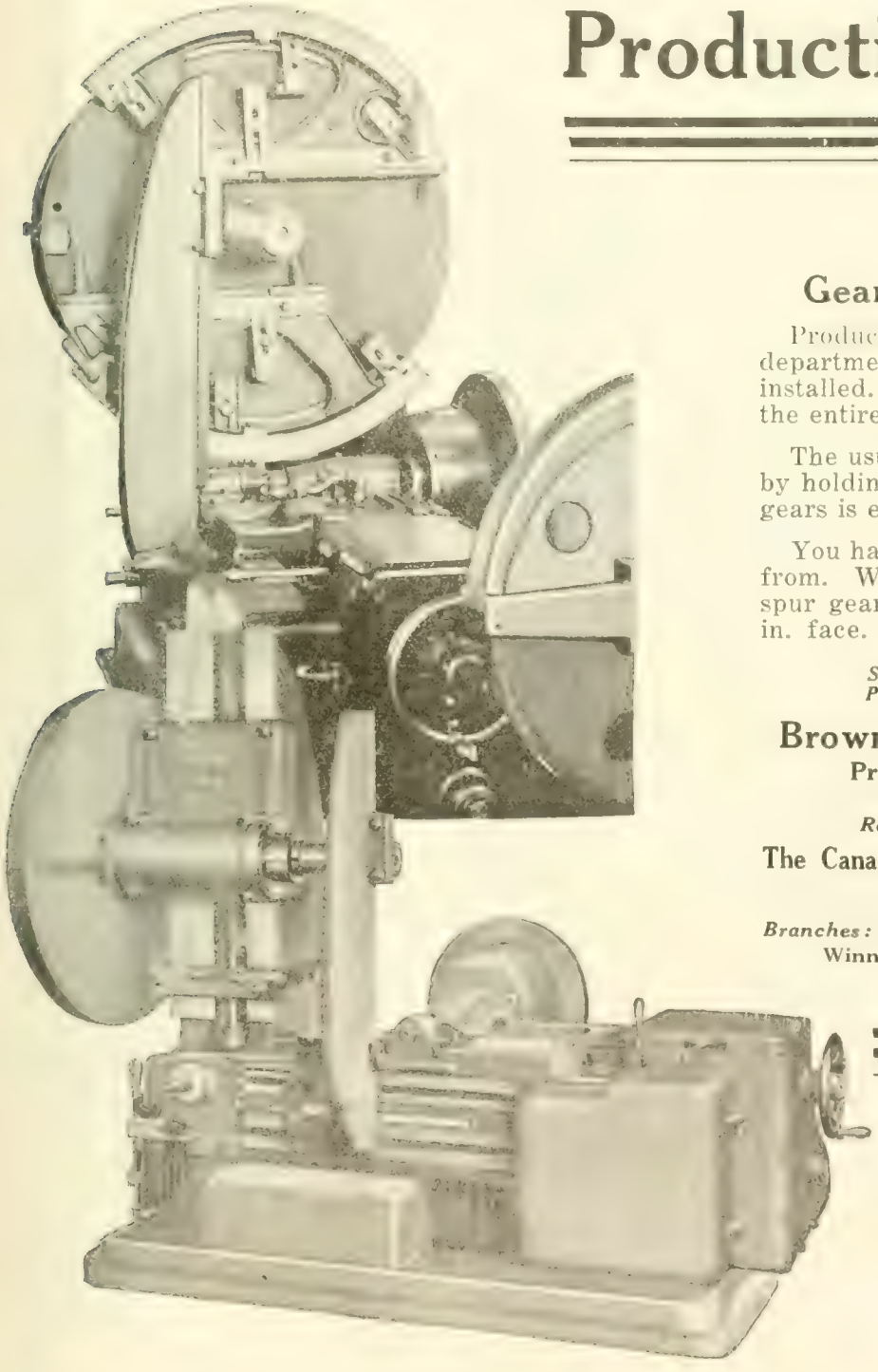

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Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.

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Bowser Co., Ltd., S. F., Toronto, Ont.

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Oliver Machinery Co. Grand Rapids, Mich

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Burgess, Clark & Co., Montreal Que.
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Wheel Trueing Tool Co., Detroit.
Williams & Wilson, Limited, Montreal.

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Wheel Trueing Tool Co., Detroit.

DIAMONDS, BLACK AND ROUGH
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Foss Mchy. & S'ply Co., G. F., Montreal.
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Garlock-Walker Machinery Co., Toronto
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Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Williams & Wilson, Limited Montreal

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Canadian Machinery Corp., Galt, Ont.
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Garlock-Walker Mach. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
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Williams & Wilson, Limited, Montreal.

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Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mach. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Nat. Automatic Tool Co., Richmond, Ind.
Rockford Drilling Mach. Co., Rockford, Ill.
Niles-Bement-Pond Co., New York.
Silver Mfg. Co., Salem, Ohio.
A. R. Williams Machinery Co., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

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Rice Lewis & Son, Toronto, Ont.
Silver Mfg. Co., Salem, Ohio.

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Can. Blower & Forge Co., Kitchener.
Can. Fairbanks-Morse Co., Montreal.
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Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Williams & Wilson, Ltd., Montreal, Que.

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Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
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Morse Twist Drill & Machine Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
Wilt Twist Drill Co., of Can., Walkerville
Williams & Wilson, Ltd., Montreal, Que.

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Butterfield & Co., Inc., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
Cleveland Twist Drill Co., Cleveland.
Geo. F. Foss Mch. & S'ply Co., Montreal
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Can., Walkerville

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Butterfield & Co., Inc., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
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Boker & Co., Inc., H., Montreal, Que.
Cincinnati Electrical Tool Co., Cincinnati
Geo. F. Foss Mch. & S'ply Co., Montreal
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Pilot Steel & Tool Co., Montreal, Que.
Prest-O-Lite Co., Inc., Toronto, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
A. R. Williams Mach. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Wilson, Ltd., Montreal, Que.

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Aikenhead Hardware Co., Toronto, Ont.
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal
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Morse Twist Drill & Machine Co., New Bedford, Mass.
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Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
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Whitman & Barnes Mfg. Co., Akron, O.
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Wilkinson & Kompass, Hamilton, Ont.
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Morse Twist Drill & Mach. Co., New Bedford, Mass.
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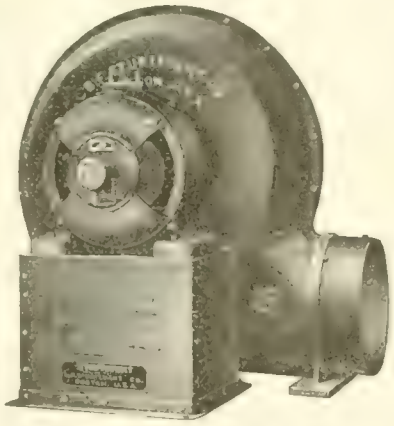

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Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
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Whitman & Barnes Mfg. Co., Akron, O.
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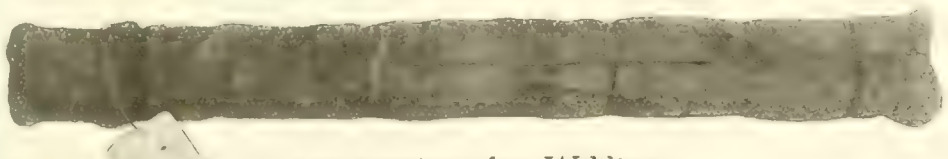

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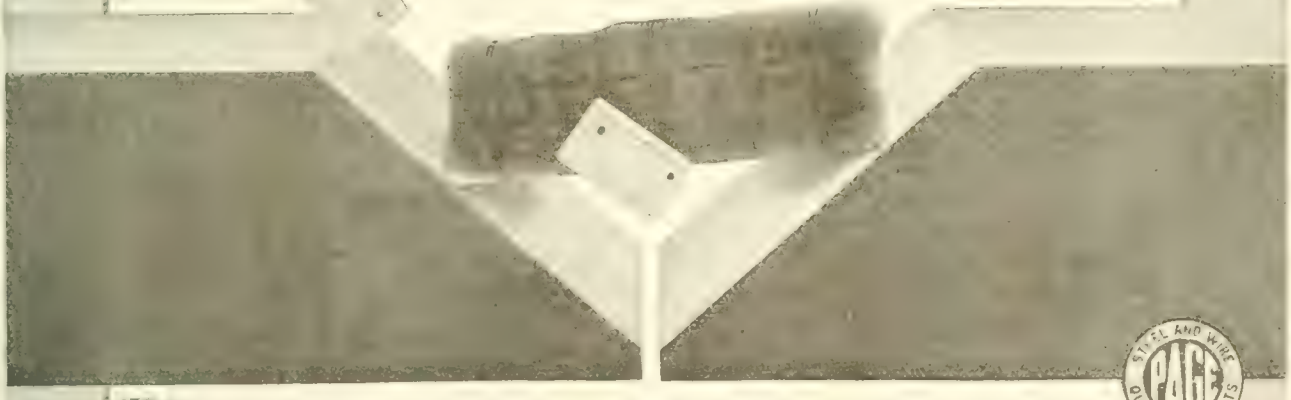

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Page Steel & Wire Co., Adrian, Mich.
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Blanche Co., L. C., New York City.
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Ford-Smith Machine Co., Hamilton, Ont.
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Diamond Saw & Stamping Wks., Buffalo.
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Peerless Machine Co., Racine, Wis.
Racine Tool & Mach. Co., Racine, Wis.
Starrett Co., L. S., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy. Co., A. R., Toronto.
Williams & Wilson, Ltd., Montreal.

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Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, HATCHETS

Wilkinson & Kompass Co., St. Catharines.

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Brown, Boggs Co., Ltd., Hamilton.
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Jardine & Co., A. B., Hespeler, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Toledo Machine & Tool Co., Toledo.
United Hammer Co., Boston, Mass.
Williams & Wilson, Ltd., Montreal

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West Tire Setter Co., Rochester, N.Y.
Williams & Wilson, Limited, Montreal.

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Independent Pneumatic Tool Co., Chicago.
Nazel Eng. & Mach. Wks., Philadelphia.

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Matthews & Co., Jas. H., Pittsburgh, Pa.

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United Hammer Co., Boston, Mass.

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Niles Bement-Pond Co., New York.

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Brown & Sharpe Mfg. Co., Providence, R.I

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Can. General Electric Co., Toronto, Ont.
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Can. S K F Co., Toronto, Ont.
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Standard Pressed Steel Co., Philadelphia
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Gray Ball Bearing Co., Ltd., Toronto.

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Butterfield & Co., Inc., Rock Island, Que.
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Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.
Williams & Wilson, Limited Montreal.

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Dominion Bridge Co., Montreal, Que.
Electric Steels & Metals Ltd., Welland.
Kennedy & Sons, Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
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Clipper Belt Lacer Co., Grand Rapids.

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Taylor Instrument Co., Rochester, N.Y.

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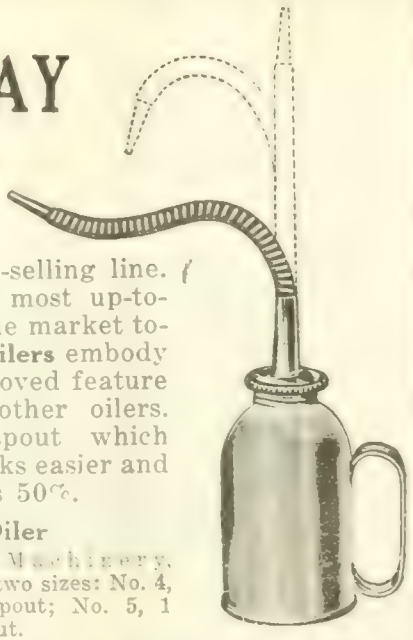

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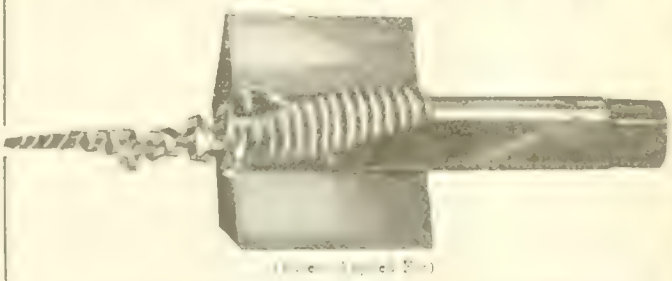

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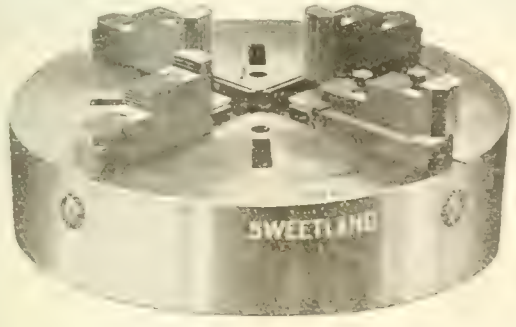

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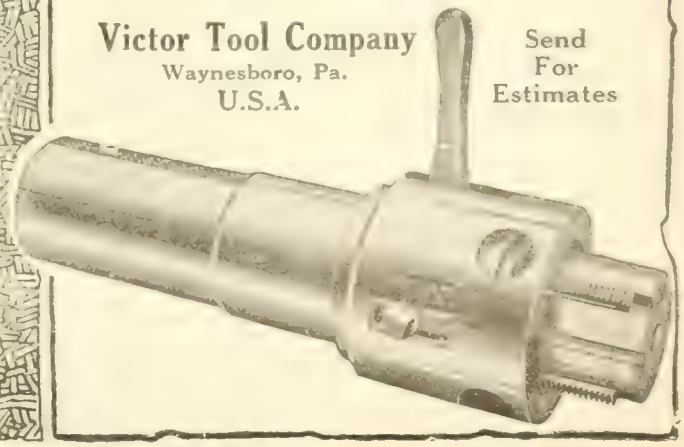

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Kempsmith Mfg. Co., Milwaukee, Wis.
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Marshall, Son & Bunney, Toronto.
Williams & Wilson, Ltd., Montreal, Que.

MILLING MACHINES, HAND

Bristol Machine Tool Co., Bristol, Conn.

MILLING MACHINES, THREAD

Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.
Gray Ball Bearing Co., Ltd., Toronto.
United States Mach. Tool Co., Cincinnati.
Pratt & Whitney Co., Dundas, Ont.
Williams & Wilson, Ltd., Montreal, Que.

MILLING MACHINES, HORIZONTAL AND VERTICAL

Becker Milling Machine Co., Boston, Mass
Bristol Machine Tool Co., Bristol, Conn.
Brown & Sharpe Mfg. Co., Providence.
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gooley & Edlund, Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Kearney & Trecker Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
United States Mach. Tool Co., Cincinnati.
Whitney Mfg. Co., Hartford, Conn.
Williams Machy. Co., A. R., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

MILLING MACHINES, PLAIN, BENCH AND UNIVERSAL

Becker Milling Machine Co, Boston, Mass.
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cleveland Milling Machine Co., Cleveland.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
National Machy. Co., Tiffin, Ohio.
Gooley & Edlund, Inc., Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Williams & Wilson, Ltd., Montreal, Que.

MILLING MACHINES, PLATE

Marshalltown Mfg. Co., Marshalltown, Ia.

MILLING MACHINES, PROFILE

Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Williams & Wilson, Ltd., Montreal, Que.

MILLING TOOLS

Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Ford-Smith Mach. Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Williams & Wilson, Ltd., Montreal, Que.

MINE CARS

Can. Fairbanks-Morse Co., Montreal.
Dominion Bridge Co., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.

MINING MACHINERY

Can. Fairbanks-Morse Co., Montreal.
Elec. Steel & Metals, Welland, Ont.
Williams Machy. Co., A. R., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

MIXERS, SAND

Frost Mfg. Co., Chicago, Ill.

MORTISING MACHINES

Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gray Ball Bearing Co., Ltd., Toronto.

MOTORS, ELECTRIC

Can. Fairbanks-Morse Co., Montreal.
Can. General Electric Co., Toronto.
Garlock-Walker Machy. Co., Toronto, Ont.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
Volta Mfg. Co., Welland, Ont.
Williams Mach'y Co., A. R., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

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The Dunbar Brothers Co., Bristol, Conn.

MOTORCYCLE FRAME AND FORK

The Dunbar Brothers Co., Bristol, Conn.

MOTORS, PNEUMATIC

Cleveland Pneumatic Tool Co. Toronto.

MOULDS, RUBBER

Hoggson & Pettis Mfg. Co., New Haven, Conn.

MULTIPLE INDEX CENTRES

Garvin Machine Co., New York.
Graton & Knight Mfg. Co., Worcester, M.

MULTI-DRILLING, MULTI-BORING, MULTI-TAPPING MACHINERY,

Nat. Automatic Tool Co., Richmond, Ind.

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Brown's Copper & Brass Roller Mills, New Toronto, Ont.

MUSIC WIRE

Blancke Co., L. C., New York City

NAIL SETS

Morrow Screw & Nut Co., J., Ingersoll, Ont

NAME PLATES, BRONZE, ETCHED AND STAMPED

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Pritchard-Andrews Co., Ottawa, Ont.
Turner Brass Works, Sycamore, Ill.

NICHROME CASTINGS

Can. Driver-Harris Co., Ltd., Walkerville.

NICKEL

Baker & Co., Inc., H., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.

NICKEL SILVER

Brown's Copper & Brass Rolling Mills, New Toronto, Ont.

NICKEL STEEL

See Steel.

NIPPLE HOLDERS

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NIPPLE THREADING MACHINES

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Landis Machine Co., Waynesboro, Pa.

NITROGEN

Carter Welding Co., Toronto, Ont.

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Galt Machine Screw Co., Ltd., Galt, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Williams & Co., J. H., Brooklyn, N.Y.

NUTS, SEMI-FINISH AND FINISHED

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National-Acme Co., Cleveland, Ohio.
Wilkinson & Kompass, Hamilton.

NUT BURRING AND NUT MACHINES (HOT)

National Machy. Co., Tiffin, Ohio.

NUT FACING AND BOLT SHAVING MACHINES

Garvin Machine Co., New York.
National Machinery Co., Tiffin, Ohio.
Victor Tool Co., Waynesboro, Pa.
Williams & Wilson, Ltd., Montreal, Que.

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Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Hall & Son, J. H., Brantford, Ont.
Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Williams & Wilson, Ltd., Montreal, Que.

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OIL SEPARATORS

Can. Fairbanks-Morse Co., Montreal.

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Norton Co., Worcester, Mass.
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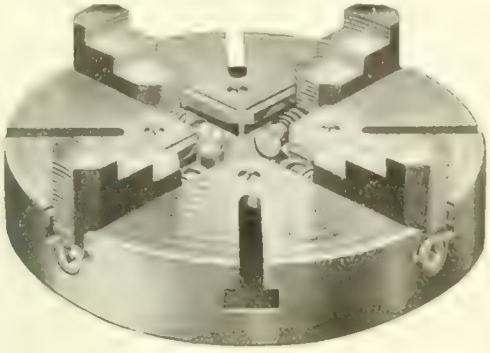

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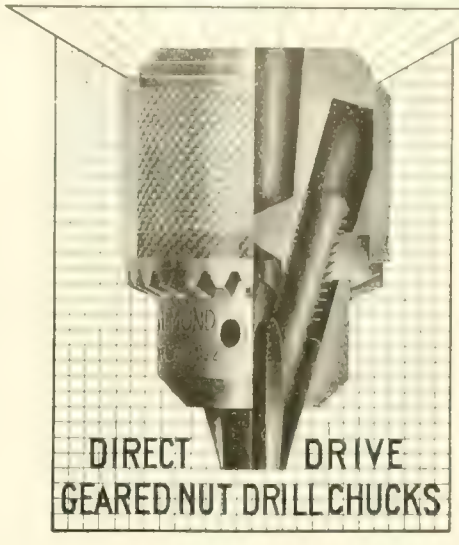

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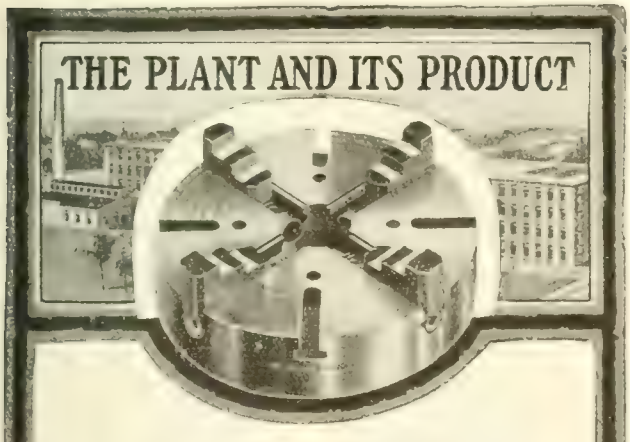

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Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Whitman & Barnes Co., St. Catharines.
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Niles-Bement-Pond Co., New York.

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Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
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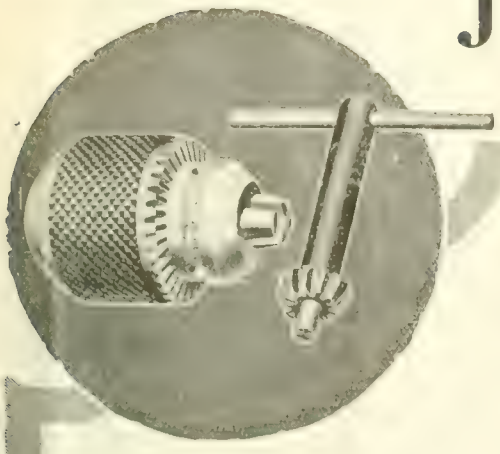

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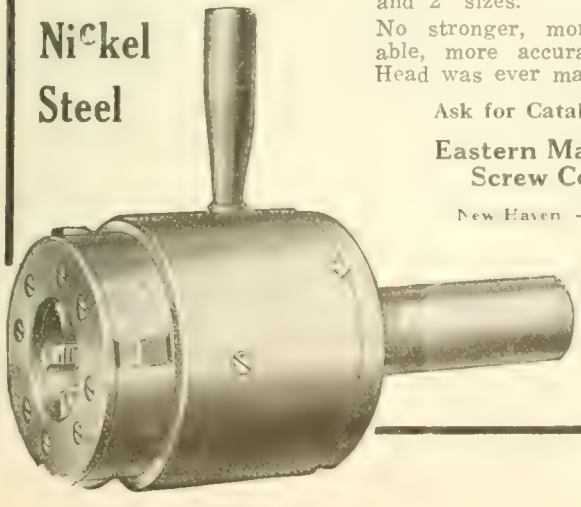

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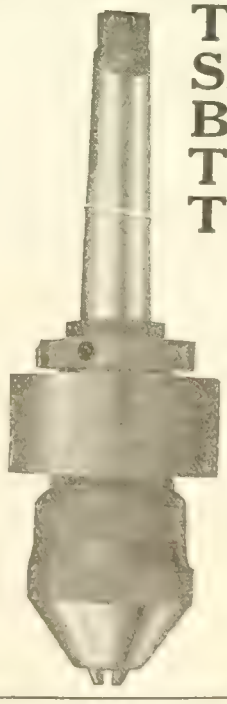

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STEEL, CARBON, FERRO-TUNGSTEN
Armstrong, Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Boker & Co., Inc., H., Montreal, Que.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent Montreal.
Latrobe Electric Steel Co., Latrobe, Pa
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL CHROME VANADIUM
Blancke Co., L. C., New York City.
General Steel Co., Milwaukee, Wis.
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm. Sheffield, Eng
Marshall, Son & Bunney, Toronto.

STEEL CHROME NICKEL
General Steel Co., Milwaukee, Wis.
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

STEEL CASTINGS
Jollette Steel Co., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound
Electric Steel & Metals Co., Welland.
Nova Scotia Steel & Coal Co., Windsor.
Swedish Crucible Steel Co., Windsor.

STEEL, COLD ROLLED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Drawn Steel Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal
Union Drawn Steel Co., Hamilton, Ont.
Warmington & Co., J. N., Montreal, P.Q.

STEEL, NICKEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Blancke Co., L. C., New York City.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto
Norton, Ralph B., Agent, Montreal.

STEEL, HIGH SPEED
Armstrong-Whitworth of Can., Montreal.
Blancke Co., L. C., New York City.
Wm. Atkins & Co., Sheffield, Eng.
Boker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal
H. A. Drury Co., Ltd., Montreal.
Firth & Sons, Thos., Montreal, Que.
Bawdsley Bros. Co., Boston, Mass.
Illingworth Steel Co., J., New York.
Kayser-Ellison & Co., Sheffield, Eng.
Latrobe Electric Steel Co., Latrobe, Pa.
Marshall, Son & Bunney, Toronto, Ont.
Norton, Ralph B., Agent, Montreal, Que.
Pilot Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, CHROME, MANGANESE
Jollette Steel Co., Montreal, Que.

STEEL, OPEN HEARTH
Illingworth Steel Co., John, New York.

STEEL, CRUSHED
Pittsburgh Crushed Steel Co., Pittsburgh.

STEEL PRODUCTS AND MACHINERY
Dom. Steel Products Co., Ltd., Brantford

STEEL, ROCK DRILL
Armstrong, Whitworth of Canada, Montreal, Que.
Kayser Ellison & Co., Ltd., Montreal
Norton, Ralph B., Agent, Montreal.

STEEL, STRUCTURAL
Algoma Steel Corp., Sault Ste. Marie.
MacKinnon Steel Co., Sherbrooke, Que.

STEEL, TOOL
Armstrong, Whitworth of Can., Montreal.
Atkins & Co., Wm., Sheffield, Eng.
Blancke Co., L. C., New York City.
Boker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal.
Drury Co., H. A., Montreal, Que.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto, Ont.
Norton, Ralph B., Agent, Montreal.
Latrobe Electric Steel Co., Latrobe, Pa.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son Toronto, Ont.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, VANADIUM
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Armstrong, Whitworth of Can., Montreal.
Drury, H. A., Co., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.
Wells Bros. of Can. Galt, Ont.

STENCILS
Hoggson & Pettis Mfg. Co., New Haven, Conn.

STOCK RACKS FOR BARS, PIPING, ETC.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

STOCKS AND DIES
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass
Wells Bros., of Can., Galt, Ont.

STOCKS, PIPE
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros., Co., of Canada, Galt, Ont.

STRAIGHTENING MACHINERY
Baird Machinery Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland.

STRAND
Dom. Steel Products Co., Ltd., Brantford.
Page Steel & Wire Co., Adrian, Mich.

SURFACE PLATES
Brown & Sharpe Mfg. Co., Providence, R.I.

STRUCTURAL STEEL WORKS
William Hamilton Co., Peterboro, Ont.

SUPPLIES, RUBBER MFRS.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

SWEDGES AND WEDGES
Whitman & Barnes Co., St. Catharines.

SWITCHBOARDS
Can. General Electric Co., Toronto, Ont.

SWITCHES, RAILWAY
Can. Steel Foundries, Ltd., Montreal.

TABLES, SAND-BLAST
Pangborn Corporation, Hagerstown, Md.

TAPPING MACHINES (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

TANKS, GASOLINE, KEROSENE AND OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Dominion Bridge Co., Montreal, Que
Dom. Forge & Stamping Co., Walkerville.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.

TANKS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.

TANKS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

TANKS, STEEL, WATER PRESSURE
Bowser Co., Ltd., S. F., Toronto, Ont.
Dominion Bridge Co., Montreal, Quebec.
MacGowern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Toronto Iron Works, Ltd, Toronto.

TANK WAGONS
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal.
Toronto Iron Works, Ltd., Toronto.

TANKS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Elec. Steel & Metals, Welland, Ont.
Geo. W. Cole, Ltd., Toronto
MacKinnon Steel Co., Sherbrooke, Que.
William Hamilton Co., Peterboro, Ont.

TAPER PINS
Galt Machine Screw Co., Ltd., Galt, Ont.

TAPES, MEASURING
James Chesterman & Co., Ltd., Sheffield, Eng.
Rice Lewis & Son, Toronto, Ont.

TAPPING MACHINES AND ATTACHMENTS
Bertram, John & Sons Co., Dundas.
Bicknell-Thomas Co., Greenfield, Mass.
Rudel-Belnap Mach. Co., Ltd., Montreal.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York
The Geometric Tool Co., New Haven.
J. H. Hall & Sons, Brantford, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchy Machine & Tool Co., Detroit.
Niles-Bement Pond Co., New York.
Rickert-Shafer Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.
L. S. Starrett Co., Athol, Mass.
Whitney Mfg. Co., Hartford, Conn.
Williams & Wilson, Limited, Montreal.

TAPES, MEASURING, STEEL AND WOVEN
Lufkin Rule Co. of Can., Windsor, Ont.

TAPES, POCKET
Lufkin Rule Co. of Can., Windsor, Ont.

TAPS, ADJUSTABLE
Boker & Co., Inc., H. Montreal Que.
Butterfield & Co., Rock Island, Que.
Geometric Tool Co., New Haven.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Pilot Steel & Tool Co., Montreal, Que.
Victor Tool Co., Waynesboro, Pa.

TAPS, GUN, HAND, BOILER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE RELIEVED
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can. Galt, Ont.

TAPS, MACHINE SCREW
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, PIPE
Butterfield & Co., Inc., Rock Island, Que
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Greenfield Tap & Die Corp., Greenfield
Marshall, Son & Bunney, Toronto.
Wells Bros. of Can., Galt, Ont.

TAPS, SPECIAL
Elliott & Whitehall, Galt, Ont.

TAPS, STAYBOLT, TAPPER
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

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Blancke Co., L. C., New York City
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland
Foss Mchy. & Sply. Co., G. F., Montreal.
Geometric Tool Co., New Haven
Greenfield Tap & Die Corp., Greenfield.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Morse Twist Drill & Mchy. Co., New Bedford, Mass.
Murcher Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son Toronto, Ont.
Starrett Co., L. S., Athol, Mass
Taylor, J. A. M., 318 Stair Bldg., Toronto.
Wells Bros. of Canada, Galt, Ont
Williams & Wilson, Ltd., Montreal, Que.

TAP EXTRACTORS
Walton Co., The Hartford, Conn.

THERMOMETERS INDUSTRIAL ENGRAVED TEMPERATURE AND PRESSURE
Taylor Instrument Co., Rochester, N.Y.

THERMOMETERS RECORDING AND INDEX
Bristol Co., Waterbury, Conn., U.S.A.
Taylor Instrument Co., Rochester, N.Y.

TESTING INSTRUMENTS, METALLURGICAL
Shore Instrument & Mfg. Co., New York.

TENOVERS
Oliver Machy. Co., Grand Rapids, Mich.

TESTING LABORATORIES
Toronto Testing Laboratory, Toronto

THREAD-CUTTING MACHINES
Can. Fairbanks-Morse Co., Montreal
Curtis & Curtis Co., Bridgeport, Conn.
Garlock-Walker Mach. Co., Ltd., Toronto.
Geometric Tool Co., New Haven.
Jardine & Co., Ltd., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.
National Machy. Co., Tiffin, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Williams & Wilson, Ltd., Montreal, Que.

THREADING TOOLS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Landis Machine Co., Waynesboro, Pa.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Canada, Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

THREADING MACHINES FOR BOLTS, NUTS AND PIPES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. Co. of Canada, Galt., Ont.
Williams & Wilson, Ltd., Montreal, Que.

THREAD MILLING MACHINES
Taft-Pierce Mfg. Co., New York, N.Y.
Gray Ball Bearing Co., Ltd., Toronto.
Smalley-General Co., Bay City, Mich.

THUMB SCREWS AND NUTS
See Screws.

TIGHTENERS, BELT
Hoggson & Pettis Mfg. Co., New Haven, Conn.

TINSMITHS' TOOLS
Brown, Boggs & Co., Hamilton, Can
Williams & Wilson, Ltd., Montreal, Que.

TIRE BENDERS
Jardine & Co., Ltd., A. B., Hespeler.

TIRE SETTING MACHINES, HYDRAULIC
Perrin, Ltd., William R., Toronto.
West Tire Setter Co., Rochester, N.Y.

TOOL CASES
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TOOL HOLDERS
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Armstrong Bros. Tool Co., Chicago.
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL POSTS, LATHE
Armstrong Bros. Tool Co., Chicago.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL ROOM PARTITIONS
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TOOLS, BENDING
Peck, Stow & Wilcox Co., Southington.

TOOLS, BLACKSMITHS'
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Rice Lewis & Son Toronto, Ont.

TOOLS, ADJUSTABLE BORING
Kelly Reamer Co., Cleveland, O.
Williams & Wilson, Ltd., Montreal, Que.

TOOLS, ELECTRIC
Independent Pneumatic Tool Co., Chicago.
Williams Machy. Co., A. R., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
U. S. Electrical Tool Co., Cincinnati, O.

TOOLS, FORMING
Davidson Tool Mfg. Co., New York, N.Y.

TOOLS, LATHE, PLANER, SLOTTER
Armstrong Bros. Tool Co., Chicago.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

TOOLS, SCREW MACHINE
Foster Machine Tool Co., Elkhart, Ind.

TOOLS, SPECIAL
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Int. Mach. & Supply Co., Ltd., Montreal.

TORCHES, STEEL
Armstrong, Whitworth of Can., Montreal.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

TORCHES, GASOLINE, KEROSENE AND ALCOHOL
Turner Brass Works, Sycamore, Ill.

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Northern Crane Works, Walkerville.

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TRANSFORMERS
Can. General Electric Co., Toronto, Ont
MacGovern & Co., Montreal, Que.

TRANSITS
Hughes, Owens Co., Ltd., Montreal, Que.

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Morris Chain Co., Ithaca, New York.

TRANSMISSION MACHINERY
American Pulley Co., Philadelphia, Pa.
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Can. Fairbanks-Morse Co., Montreal.
Can. Drawn Steel Co., Hamilton, Ont.
Coventry Chain Co., Coventry, England.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Kennedy & Sons, Wm., Owen Sound, Ont.
Morse Chain Co., Ithaca, N.Y.
Wilson & Co., J. C., Belleville, Ont.
Williams Machinery Co., A. R., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

TRANSMISSION ROPE
Jones & Glassco, Montreal, Que.
MacKinnon Steel Co., Ltd., Sherbrooke.
Wilson & Co., J. C., Belleville, Ont.

TRANSMISSION TOWERS
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
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Tallman Brass & Metal Co., Hamilton.

TROLLEYS
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

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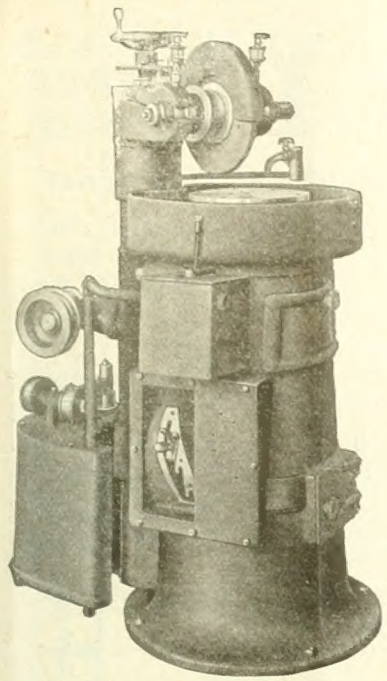
Canada Machinery Corp., Galt, Ont.
Chapman Double Ball Bearing, Toronto.
MacKinnon Steel Co., Sherbrooke, Que.
Rice Lewis & Son, Toronto, Ont.

TRUCKS, FLOOR
Beatty Bros., Fergus, Ont.



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Niles-Bement-Pond Co., New York.
Williams Machy. Co., A. R., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

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Marshall, Son & Bunney, Toronto.
Wells Bros. Co. of Canada, Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.
Williams & Wilson, Ltd., Montreal, Que.

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Williams & Wilson, Ltd., Montreal, Que.

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Marshall, Son & Bunney, Toronto.
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Norton, Ralph B., Agent, Montreal.
London Bolt & Hinge Wks., London, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

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Wood Turret Machine Co., Brazil, Ind.

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Welding & Supplies Co., Montreal, Que.
Tabor Mfg. Co., Philadelphia, Pa.

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Strong, Kennard & Nutt Co., Cleveland.

WELDING GOGGLES
Davis-Bournonville Co., Toronto, Ont.
Strong, Kennard & Nutt Co., Cleveland.

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Davis-Bournonville Co., Toronto, Ont.
Page Steel & Wire Co., Adrian, Mich.
Welding & Supplies Co., Montreal, Que.

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Union Carbide Co., Toronto, Ont.
Nat. Electro Products Ltd., Toronto, Ont.

WELDLESS BOILER TUBES
Furniss, Clarke & Co., Montreal, Que.

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Williams & Wilson, Ltd., Montreal, Que.

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Elec. Steel & Metals, Welland, Ont.

WHEELS, PRESSED STEEL
American Pulley Co., Philadelphia, Pa.

WHEEL TRUEING TOOLS
Wheel Trueing Tool Co., Windsor, Ont.
Williams & Wilson, Ltd., Montreal, Que.

WINCHES
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Hall & Sons, John H., Brantford.
Kennedy & Son, Wm., Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

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Norton, Ralph B., Agent, Montreal.

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Shuster Co., F. B., New Haven, Conn.

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Quickwork Co., St. Marys, Ohio.

WRENCHES, PIPE, POWER
Peck, Stow & Wilcox Co., Southington.

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Page Steel & Wire Co., New York, N.Y.

WIRE FENCING

WIRE, COPPER, CLAD STEEL

WIRE, LINK FABRIC
Page Steel & Wire Co., Adrian, Mich.

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Brown, Boggs Co., Ltd., Hamilton, Can.
Shuster Co., F. B., New Haven, Conn.

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Page Steel & Wire Co., New York, N.Y.
Parmenter & Bulloch Co., Gananoque.
Steel Co. of Canada, Ltd., Hamilton, Ont.

WIRE NAIL MACHINERY
National Machy. Co., Tiffin, Ohio.
Page Steel & Wire Co., New York, N.Y.

WIRE, SPARK PLUG, MANGANESE NICKEL, COPPER NICKEL, MONEL METAL
Can. Driver-Harris Co., Ltd., Walkerville.

WIRE SPRING
Page Steel & Wire Co., Adrian, Mich.

WIRE STEEL, BRASS, COPPER
Page Steel & Wire Co., New York.
Steel Co. of Canada, Ltd., Hamilton, On.

WIRE, TELEPHONE, TELEGRAPH, GALVANIZED AND ELECTRICAL
Page Steel & Wire Co., Adrian, Mich.

WIRE, WEAVING, MONEL METAL, BRASS, COPPER, GOLDEN BRONZE, HIGH BRASS, LOW BRASS, NICKEL
Can. Driver-Harris Co., Ltd., Walkerville.

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Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Williams & Wilson, Ltd, Montreal, Que.

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Brown, Boggs Co., Ltd., Hamilton, Can.
Shuster Co., F. B., New Haven, Conn.

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Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto.
Oliver Machy. Co., Grand Rapids, Mich.
Silver Mfg. Co., Salem, Ohio.
Williams Machy. Co., A. R., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

WOOD TRIMMERS AND LATHES
Oliver Machy. Co., Grand Rapids, Mich.

WOOD MILLING MACHINES AND SHAPERS
Oliver Machy. Co., Grand Rapids, Mich.

WRENCHES
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Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Rock Island, Que.
Canada Fdrs. & Forg., Ltd., Welland.
Keystone Mfg. Co., Buffalo, N.Y.
Wells Bros. of Canada, Galt, Ont.
Whitman & Barnes Co., St. Catharines.
Whitman & Barnes Mfg. Co., Akron, O.

WOVEN STEEL PARTITIONS
Page Steel & Wire Co., Adrian, Mich.

WRENCHES, AUTOMOBILE, NARROW JAW, MONKEY, SCREW
Morrow Screw & Nut Co., Ingersoll, Ont.
Whitman & Barnes Co., St. Catharines.

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Aikenhead Hardware Co., Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Peck, Stow & Wilcox Co., Southington.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. of Canada, Galt, Ont.
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Keystone Mfg. Co., Buffalo, N.Y.
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Williams & Wilson, Ltd., Montreal, Que.

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Williams & Wilson, Ltd., Montreal, Que.

Hendey centering machine on centering work in plant of Can. General Electric Co. on all sorts of portions of their product.

HENDEY IMPROVED CENTERING MACHINE

Assures Perfect Results at Low Cost

The distribution of metal insures the maximum strength with the least weight of machine; in this manner we have conserved on material and hence on machine cost.

Here are a few of the **Hendey** Improved Centering Machine features:—

The head is rigidly clamped to the bed, giving permanent alignment of spindle. Spindle is large in diameter with ample bearings, having felt oilers. Front journal is made taper, after the well-known pattern of our lathe and milling machine spindles.

Jaws of vise and supporting block are made of steel, hardened and ground.

Capacity of machine is from 5-16 to 4 inches inclusive.

The Hendey Improved Centering Machine has many more points of interest. May we send you full description?

CANADIAN AGENTS: A. R. Williams Machinery Co., Toronto, Ont.; A. R. Williams Machinery Co., 260 Princess St., Winnipeg; A. R. Williams Machinery Co., Vancouver; A. R. Williams Machinery Co., St. John, N. B.; Williams & Wilson, Montreal

The Hendey Machine Company, Torrington, Conn., U. S. A.

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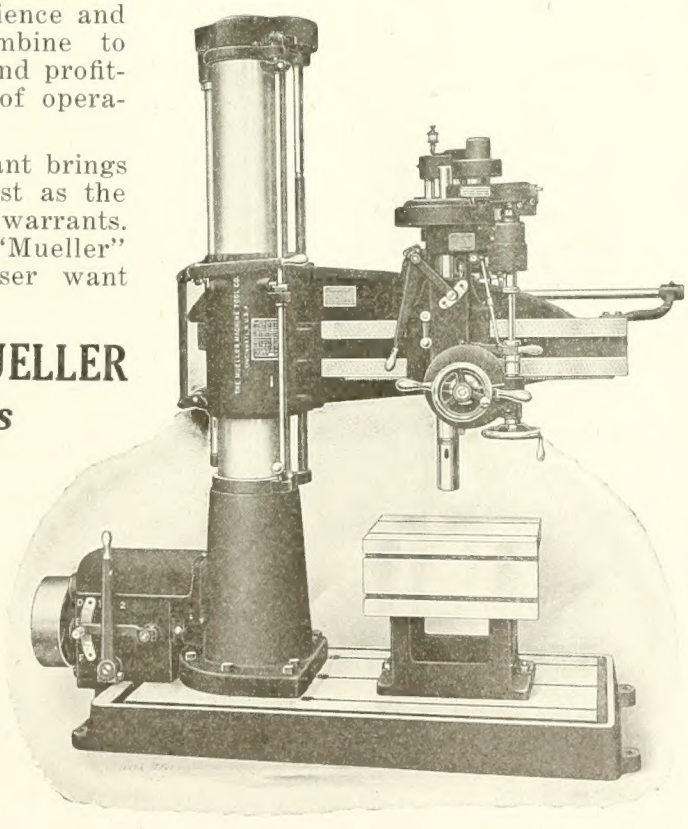

The Geo. F. Foss Machinery & Supply Co., Limited

Machinery and Supplies

305 St. James Street, Montreal, Que.

No. 107

Foss QUALITY Foss SERVICE Foss

C.M.C.

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FOR IMMEDIATE DELIVERY

We have in stock the following list of New and Second-Hand Wood Tools which we offer for immediate acceptance subject to prior sale

AT SPECIALLY REDUCED PRICES

PLANERS

Quantity	Make	Size		
2	Sussex		Planer and Matcher, Eastern Monarch	New
1		30″	Cabinet Planer and countershaft	Second-hand
1	Ross	24″	Planer and Matcher	Second-hand
3	Sussex	16″	Buzz Planers	New
1	Goldie & McCulloch		Buzz Planer	Second-hand
1	McGregor-Gourlay	24″ x 7′	Planer, single suface	New
1	Falls		Self-feeding Attachment	New

MOULDERS

1	McGregor-Gourlay	12″	Moulder	Second-hand
1	Cowan	13″	Moulder	Second-hand
1	Gledhill		Moulder for Sash, double table	Second-hand

MORTISERS

5	McGregor-Gourlay		Mortisers, Power	New
1	Goldie & McCulloch		Mortiser and Tenoner	Second-hand
1	Clark & Demille		Mortiser, Power	Second-hand

TENONERS

1	Goldie & McCulloch		Tenoner, Blind Slat	Second-hand
1			Tenoner, Wood Frame	Second-hand
1	Cowan		Tenoner, Blind Slat	Second-hand
1	Fay & Egan		Tenoner, Blind Slat	Second-hand

SHAPERS

1	McGregor-Gourlay		Shaper	New
1	Sussex		Shaper, heavy, with special C/S	New

SANDERS

1	Peerless		Sander	Second-hand
1	Jackson-Cochrane	48″	Three-Drum Sander	Second-hand
1	Lucas		Sander	New
1	Lucas		Sander, with Extension Carriages	New

SAW TABLES

1	McGregor-Gourlay		Saw, roller table cut-off, 7′ table	Second-hand
1	Goldie & McCulloch		Saw Table	Second-hand
1	Ballantine		Saw Table	New

BAND SAWS

1	Ballantine	30″	Bracket Band Saw	New
1	McGregor-Gourlay	42″	Self-Feed Band Rip Saw	Second-hand
1	Cowan	36″	Circular Re-Saw	Second-hand

RIP SAWS

1	Cowan		Rip Saw	Second-hand
1	McGregor-Gourlay		Saw, with countershaft	Second-hand

BORING MACHINES

1	Sussex		Belt-Driven Post Borer	New
1	Goldie & McCulloch		Post Borer	New
1	Goldie & McCulloch		Spindle Borer	Second-hand
1			Blind Style Borer	Second-hand

SUNDRY MACHINES

3	Goldie & McCulloch	16″	Single End Wood Lathes	New
1	Jackson & Cochrane		Continuous Feed Glue Jointer	Second-hand
1	Ballantine		12-spindle Dovetailer	Second-hand
1	Sussex	12″ x 44″	Veneer Press, 3 screws	New
1	Clark & Demille	12″ x 44″	Veneer Press	New
1	Ballantine	12″ x 50″	Veneer Press, 4 screws	New
1	Sussex		Double Emery Grinder	New
1	Sussex		Double Emery Grinder, two step cone	New

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